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SOUTHWESTERN COASTAL BASIN

GREENWICH, CONNECTICUT

AMERICAN FELT DAM
CT 00043

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

FEBRUARY, 1980

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Greenwich, Conn.
American Felt Dam

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This dam is a concrete rubble and masonry construction with earth embankments on each side. The dam is approx. 208 ft. long, 37 ft. high and has a top width of 13 ft. It was constructed about 1867 and presently serves only an aesthetic function. This dam is classified as SMALL in size and a HIGH hazard potential structure in accordance with recommended guidelines established by the Corps of Engineers. The test flood for this dam is ½ the PMF. The test flood has an outflow discharge equal to 13000 cfs and will overtop the dam by 7.4 ft. in a stillwater condition. The maximum outflow capacity of the spillway under stillwater conditions is 1335 cfs which is 10 percent of the test flood.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF
NEDED

MAR 2 1 1980

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

Inclosed is a copy of the American Felt Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, Fairfield Associates, Inc., Greenwich, Connecticut.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

SOUTHWESTERN COASTAL BASIN

GREENWICH, CONNECTICUT

AMERICAN FELT DAM

CT 00043

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I - INSPECTION REPORT

Identification No.:	CT 00043
Name of Dam:	American Felt Dam
Town:	Greenwich
County and State:	Fairfield, Connecticut
Stream:	Byram River
Date of Inspection:	November 12, 1979

BRIEF ASSESSMENT

This dam is a concrete rubble and masonry construction with earth embankments on each side. The dam is approximately 208 feet long, 37 feet high and has a top width of 13 feet. It was constructed about 1867 and presently serves only an aesthetic function.

Based on the visual inspection and past operational performance, the dam is judged to be in FAIR condition. Seepage was noted on the downstream face. Both faces are vegetated and in need of repointing, and a few stones are missing from the dam at the ends of the spillway.

This dam is classified as SMALL in size and a HIGH hazard potential structure in accordance with recommended guidelines established by the Corps of Engineers.

The test flood for this dam is 1/2 the Probable Maximum Flood (PMF). The test flood has an outflow discharge equal to 13000 cfs and will overtop the dam by 7.4 feet in a stillwater condition. The maximum outflow capacity of the spillway under stillwater conditions is 1335 cfs which is 10 percent of the test flood.

It is recommended that the following items be studied further: The leakage of the 60 inch outlet pipe sluice gate; seepage on the downstream face; the toe; the upstream face; and the spillway capacity.

Recommendations and remedial measures that should be implemented by the Owner within one year period after receipt of this Phase I Inspection Report, are further described in Section 7.

JAMES P. PURCELL ASSOCIATES, INC.

Sudhir A. Shah, P.E.
Vice-President
Connecticut P.E. No. 8012

This Phase I Inspection Report on American Felt Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Richard J. DiBuono

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

Aramast Mahtesian

ARAMAST MAHTESIAN, CHAIRMAN
Foundation & Materials Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation. However, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there by any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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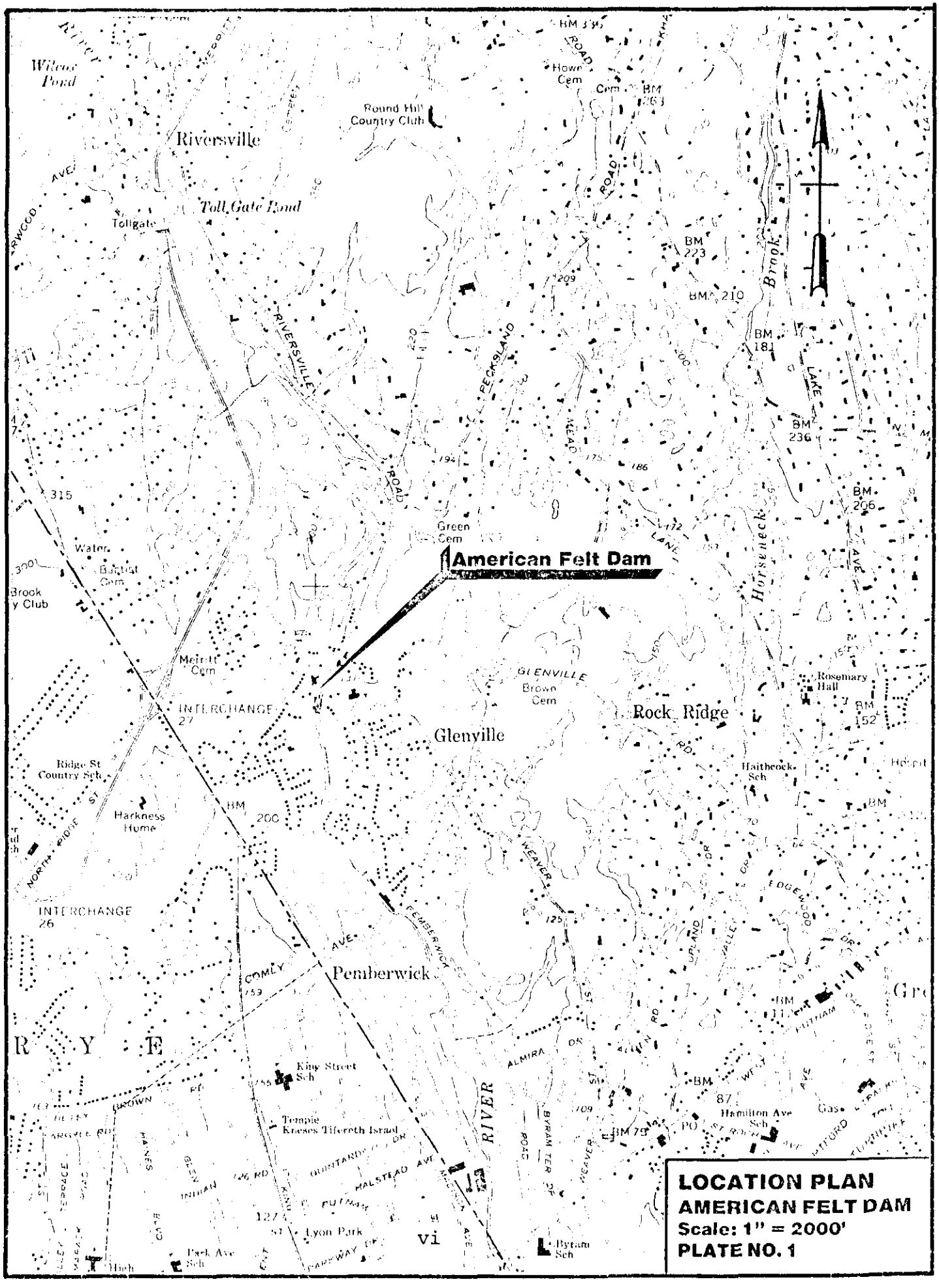


LOCATION PLAN
AMERICAN FELT DAM
Scale: 1" = 2000'
PLATE NO. 1

NATIONAL DAM INSPECTION PROGRAM

PHASE I - INSPECTION REPORT

NAME OF DAM: AMERICAN FELT DAM

SECTION 1

PROJECT INFORMATION

1.1 General

a. **Authority:** Public Law 92-367, August 8, 1972, authorized the Secretary of the Army through the Corps of Engineers to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. James P. Purcell Associates, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to James P. Purcell Associates, Inc., under a letter from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-80-C-0002 has been assigned by the Corps of Engineers for this work.

b. **Purpose of Inspection**

1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

2. Encourage and prepare the States to initiate quickly, effective dam safety programs for non-Federal dams.

3. To update, verify and complete the National Inventory of Dams.

1.2 Description of Project:

a. **Location**

The American Felt Dam is located in Fairfield County, Connecticut, in the Village of Glenville near the Connecticut, New York state line. (See Plate No.

1). The dam impounds water from the Byram River and is located approximately 4 miles upstream from Long Island Sound and 3000 feet upstream of the Pemberwick Dam. The impoundment is situated in a north/south direction with the dam located at the southern end. The latitude is 41° -02'-18" and the longitude is 73° -40'-00".

b. **Description of Dam and Appurtenances**

The American Felt Dam, built about 1867, is constructed of cement rubble masonry with a sloped (1H:10V) downstream face and a stepped back face. The spillway section is arched in plan with a length of 49 ft. The top of the dam has a 4 inch concrete cap. There are concrete paved overflow channels below the east and west portion of the dam to protect buildings located immediately downstream of the dam from flood waters overtopping the dam. Cement rubble and stone masonry retaining walls extend from the downstream face, perpendicular to the dam, defining the stream channel to a distance of 800 ft. downstream.

An earth dike extends from the end of the west crest upstream, parallel to the river.

One inlet, consisting of a wooden rectangular slidegate, controls the discharge into a 60 inch pipe through the dam, which at one time supplied water to the downstream factory building. The outlet is now permanently sealed within the building but may be drained via a 6 inch tap. The bottom of the slide gate is located 14 feet below the spillway level on the east side of the dam. The manually operated gate lift mechanism is located on the top of the dam on the east side.

Another inlet to a 12 inch diameter pipe through the dam, is located approximately 12 feet upstream and on the east side of the dam. The inlet pipe is approximately 12 feet below the water surface and is controlled by a manually operated valve in a pit just below the east overflow channel. The pipe extends to the downstream factory building where it terminates in a blind flange, which consists of a removable bolted plate covering the end of the pipe.

Two other low level outlets indicated on the record drawings are no longer operational.

c. **Size Classification**

The dam is classified as a SMALL structure as per the criteria set forth in the Recommended Guidelines for the Safety Inspection of Dams by the Corps of Engineers. The impoundment storage at the dam's crest is 49 acre-feet (range

equals 50 to 1000 acre-feet) and the maximum height of the dam is 37 feet (within the range 25 to 40 feet). The size classification is based on both the height and storage criteria.

d. Hazard Classification

The dam is classified as a HIGH hazard potential structure as per the criteria set forth in the Recommended Guidelines for the Safety Inspection of Dams by the Corps of Engineers. Residential homes and an industrial plant are located on the banks of the downstream channel, where failure discharge can cause the loss of more than a few lives and can cause excessive damage, due to high velocity impact from debris and flooding. The estimated water depth due to the possible dam failure may range from 15.5 feet at the dam to 6.2 feet above normal at the Pemberwick Dam.

The failure of the American Felt Dam may have a potential hazardous effect on the downstream Pemberwick Dam.

e. Ownership

The American Felt Dam is presently owned by Fairfield Associates, Inc., 100 Putnam Green, Greenwich, Connecticut, 06830. The property was acquired in 1979 from the GAF Cooperation, Wayne, New Jersey as a development investment. Subsequent to the development of the property, the owners will be a condominium association.

f. Operator

The operator and caretaker for the American Felt Dam is:

Mr. John Koslowski, Maintenance Supt.
Fairfield Associates, Inc.
6 Glenville Street
Greenwich, CT 06830
Telephone: 531-1822 (mill)
531-9093 (home)

g. Purpose of Dam

The American Felt Dam impounds water from the Byram River. In the past, the dam supplied water power to the adjacent downstream mill. However, its present purpose is only aesthetic.

h. **Design and Construction History**

The American Felt Dam was constructed after the Civil War in 1867 to furnish water power to the adjacent mill buildings. In about 1955, walls were built on the top of the dam and the overflow channels below the dam were constructed (the existing east channel was improved). The earth dike extending the western top of the dam upstream was built in 1973.

i. **Normal Operating Procedures**

The dam, as it is presently used, requires no attention for normal operating procedures.

1.3 Pertinent Data

a. **Drainage Area**

The American Felt Dam is located in Fairfield County, Connecticut. The drainage basin lies approximately 1.0 miles north of the Village of Pemberwick. The basin is generally rectangular in shape having a length of 11.2 miles and an average width of 2.2 miles. The total drainage area to the dam is 25.4 square miles. (See drainage basin map in Appendix D.) The topography is generally rolling to moderate terrain, with elevations ranging from a high of 740.0 to 100.0 at the spillway crest. Stream and basin slopes are flat to moderate having average grades of 0.9 percent to 1.2 percent, respectively. The normal pond surface area is 2.6 acres which is approximately 0.02 percent of the watershed.

All elevations in this report are based on the National Geodetic Vertical Datum (NGVD). Elevations are based on a spillway crest elevation of 100.00 estimated from available mapping.

b. **Discharge at Dam Site:** Discharge records are limited to estimated flows for the 1938 and 1955 storms (Refer to Section 5.3 - Experience Data). Listed below are calculated discharge values for the spillway and the 12 inch outlet. The 60 inch outlet can be drained only by a 6 inch tap with an approximate discharge of 4 cfs at a pool elevation of 104.7 (top of dam).

1. Outlet Works: A 12 inch pipe with an intake approximately at elevation 88.0 and a discharge capacity of 13 cfs at elevation 100.0.

2. Maximum known flood at dam site: Estimated by an unknown source to have been 3000 cfs in October, 1955.

3. Spillway capacity at top of dam: 1335 cfs at elevation 104.7.

4. Spillway capacity at test flood: 5570 cfs at elevation 112.1.

5. Gated outlet capacity at normal pool elevation 13 cfs at elevation 100.0.

6. Gated outlet capacity at test flood elevation 19 cfs at elevation 112.1.

7. Gated outlet capacity at top of dam elevation 15 cfs at elevation 104.7.

8. Total project discharge at top of dam 1350 cfs at elevation 104.7.

9. Total project discharge at test flood elevation 5590 cfs at elevation 112.1.

c. **Elevation**(Feet Above NGVD)

1.	Streamed at toe of dam	67.7
2.	Bottom of cutoff	Unknown
3.	Maximum tailwater	Unknown
4.	Recreation pool	N/A
5.	Full flood control pool	N/A
6.	Spillway crest	100.0
7.	Design surcharge (Original Design)	Unknown
8.	Top of dam	104.7
9.	Test flood level	112.1

d. **Reservoir**(Length in feet)

1.	Normal pool	400
2.	Flood control pool	N/A
3.	Spillway crest pool	400

4.	Top of dam	400
5.	Test flood pool	600

e. **Storage** (acre-feet)

1.	Normal pool	36
2.	Flood control pool	N/A
3.	Spillway crest pool	36
4.	Top of dam	49
5.	Test flood pool	72

f. **Reservoir Surface** (acres)

1.	Normal pool	2.6
2.	Flood control pool	N/A
3.	Spillway crest	2.6
4.	Test flood pool	3.5
5.	Top of dam	2.8

g. **Dam**

1.	Type	Cement rubble masonry
2.	Length	208 feet
3.	Height	37 feet
4.	Top Width	13 ft. at spillway
5.	Side slopes	Upstream: Vertical above spillway Downstream: 1H:10V
6.	Zoning	Unknown

7.	Impervious core	Unknown
8.	Cutoff	Unknown
9.	Grout curtain	Unknown

h. **Dike** — An earth embankment with a concrete wall on the downstream face continues the western top of the dam upstream.

i. **Diversion and Regulating Tunnel** — N/A

j. **Spillway**

1.	Type	Overflow, broad crested, uncontrolled weir.
2.	Length of weir	49 feet
3.	Crest elevation	100.0
4.	Gates	None
5.	U/S Channel	Natural Bed
6.	D/S Channel	Cement rubble and stone masonry retaining walls to a distance of 800 ft. downstream.

k. **Regulating Outlets**

Refer to Paragraph 1.2b - "Description of Dam and Appurtenances" for description of Outlet Works.

1.	Inverts and Size:	86.0 - 60 in. pipe 88.0 - 12 in. pipe
2.	Description:	Cast Iron Pipes
3.	Control Mechanisms:	Sluice gate for 60 inch pipe. Gate valve for 12 inch pipe.

SECTION 2

ENGINEERING DATA

2.1 Design

There are limited available records presenting design information for the construction of the American Felt Dam. A 1917 plan of the inlet for the 60 inch pipe outlet has been included in Appendix B of this report. Plans made during previous inspections, one in 1938 and one in 1956, are also included in Appendix B of this report.

2.2 Construction

There are no available records of the construction of this dam. Walls on the crest and the overflow channels were constructed about 1955, and it is assumed that the 1956 drawing illustrates the "as built" condition.

2.3 Operation

No formal records of operation are kept for this facility. The only data which is recorded is the daily water temperature via a permanent thermocouple. The dam is inspected weekly by personnel from Greenwich Associates, Inc., developers of the surrounding property inclusive of the American Felt Dam. The dam has only an aesthetic use at this time.

2.4 Evaluation

a. **Availability:** The information noted above for this facility is available in the file of the Department of Environmental Protection, Water and Related Resources Unit, Dam Safety Engineers, State Office Building, Hartford, Connecticut, and Greenwich Associates, Inc., Greenwich, Connecticut.

b. **Adequacy:** The lack of indepth engineering did not allow a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on the visual inspection, the dam's past performance, and sound engineering judgment.

c. **Validity:** The validity of the limited information available must be verified.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. **General:** The visual inspection of the American Felt Dam was conducted on November 12, 1979 and a copy of the visual inspection check list is contained in Appendix A of this report.

The following precedure was used:

1. Inspection of the upstream reach of the river which was impounded by the dam.

2. Visual inspection of the face and top of the dam and spillway for cracks, loose stones, leakage, etc.

3. Inspection of the outlet works and other appurtenances as to their existence, location, and operability.

4. Review of procedures that could be utilized in the event of an emergency situation.

5. A check of the downstream area for seepage, piping, boils or other indications of abnormal conditions. The downstream hazard potential in the event of dam failure was investigated.

6. Photographs of the general area of the dam and of specific items of note were taken and are included in Appendix C of this report.

Before the inspection, the available existing data and aerial photographs were studied and reviewed.

b. **Dam**

1. Crest: The top of the dam is constructed of stone masonry with a 4 inch concrete cap (Photo C-2). There was no evidence of settlement or misalignment. There are low stone walls on the ends of the top of the dam, which were constructed about 1955 to increase the flood capacity of the dam (Photo C-6). The top is generally in good condition with some minor cracking of the concrete cap noted.

2. Upstream Slope: The upstream face of the dam is stone masonry with a vertical face above the water level, which, at the time of inspection, was approximately 46 inches below the east top elevation. Grass and shrubs were growing in the joints between some of the stones.

3. Downstream Slope: The downstream face is also stone masonry with a nearly vertical face. See Appendix B for a typical section through the dam. Grass, shrubs, and small trees were growing between some of the stones. Minor leakage was noted through the abutments and through the masonry at several points and mortar is missing in several joints (Photo C-9). The dam appears to be founded on bedrock.

   Overflow channels were constructed in about 1955 just downstream of the dam to channel water flowing over the dam during flood conditions back to the river. The east channel existed prior to 1938 but was improved in 1955. The channels consist of a masonry wall downstream of the dam and a paved (concrete) invert (Photos C-7, 8). Grass and small shrubs are growing from cracks in the concrete and between the stones.

c. **Dike:** A dike continues upstream parallel to the river from the end of the western top of the dam (Photo C-4). It is an earth fill structure with a concrete wall on the downstream face. It appears to be generally in good condition with a good grass cover. However, several shrubs and small trees are growing on the embankment.

d. **Appurtenant Structures**

1. Spillway: The spillway is a 49 foot long and 13 foot wide broad crested weir with a free drop of approximately 24 feet to the tailwater (Photo C-1). It is constructed of capstones and is flush with the downstream face of the dam. Water was flowing over the spillway at the time of the inspection. However, it was noted that several stones were missing from the walls at the ends of the spillway (Photos C-3, 4).

2. Low Level Outlets: Record drawings indicate the presence of a low level outlet on the east side of the dam and a square opening was noted on the downstream face. However, there was no indication of how the outlet was regulated. Representatives of the owner believe it to be inoperable and the present silt level on the upstream side of the dam indicate that the intake is buried. An opening on the west side of the dam, as indicated on record drawings, was covered by the construction of the overflow channel.

3. 60 Inch Pipe Outlet: This outlet is regulated by a sluice gate located on

the east side of the dam approximately 14 feet below the spillway level. The sluice gate is controlled by a lift mechanism on the eastern top of the dam and appears to be operational (Photo C-5). It was operated in 1968 - 1969 for cleaning and again in 1977, at which time it would not close fully, resulting in leakage.

The pipe extends through the dam to the former American Felt Company building downstream on the east bank of the river. A vent pipe connected to this outlet pipe is located just downstream of the dam and the water level was noted as being approximately equal to the pond level.

The pipe is permanently sealed off within the building by a welded and bolted cap over the end, but may be drained via a 6 inch line to a rectangular masonry channel extending from within the building to the river. An apparent groundwater flow of approximately 5 gpm was noted into this channel.

4. 12 Inch Pipe Outlet: A free access intake is located on the east embankment, approximately 12 feet upstream of the dam and 12 feet below the spillway level. The pipe extends through the dam and continues to the former American Felt Company building on the east bank of the river downstream. It is regulated by a valve located in a covered pit on the downstream slope of the dam just below the overflow channel (Photo C-10). The 12 inch line terminates in a removable blind flange (bolted plate over end) in the building and was last used in 1972 - 1973.

e. **Reservoir Area:** The impoundment created by the dam is a narrow flooded portion of the natural riverbed. There are fairly gentle slopes on the valley walls surrounding the reservoir. Bedrock appears to be at or near the surface. No geologic features were detected that could be expected to adversely affect the dam or its appurtenance structures.

Trespassing on the dam is prohibited. However, the area is not fenced and is located near well-traveled roads. No evidence of trespassing was noted during this inspection.

f. **Downstream Channel:** The downstream channel is fairly straight and uniform with stone walls on both sides for approximately 800 feet downstream (Photo C-11). A bridge is located across the channel 150 feet downstream from the dam (Photo C-12) and a small dam, approximately 7 feet high, is a short distance downstream beyond the bridge.

3.2 Evaluation

Based on the visual inspection, the American Felt Dam appears to be in fair condi-

tion overall, and there were no major areas of distress noted. Specific areas of concern that were noted are:

The presence of leakage on the downstream face and vegetative growth on the faces of the dam.

The missing stones at the edges of the spillway and missing grout between stones on the faces.

The structural integrity cannot be evaluated due to the unknown conditions within and below the dam.

SECTION 4

OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

There are presently no operational procedures for the American Felt Dam. It has only an aesthetic purpose at this time.

4.2 Maintenance of the Dam

There is no regular maintenance schedule for this dam. The downstream channel is contained by stone retaining walls and is relatively free of vegetation. Upstream of the dam, the shore is in a natural state.

4.3 Maintenance of the Operating Facilities

Since they are no longer used for industrial purposes, maintenance of operating facilities has been lax. The inlet gate for the 60 inch outlet was last operated in 1968-1969 for cleaning the flume. In 1977, the gate was exercised again but would not close fully resulting in constant leakage through the wooden rectangular slide gate.

4.4 Description of Any Warning System in Effect:

No formal emergency or contingency plan is in effect to reduce or minimize downstream damage in emergency situations.

4.5 Evaluation

To insure the safety of the residents and industries immediately downstream, a regular inspection and maintenance program should be developed and implemented.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

The American Felt Dam, built across the Byram River, creates an impoundment with a total storage capacity of 36 ac-ft at the spillway elevation of 100.0. Each foot of depth in the pond above the spillway crest can accommodate approximately 2.6 ac-ft. The spillway is a 49 foot long by 13 foot wide broad crested weir. Stream and basin slopes are flat to moderate having average grades of 0.9 percent to 1.2 percent respectively.

5.2 Design Data

a. Flood calculations were done by the State of Connecticut in November, 1955 and yielded a 100-year frequency flood of 3320 cfs for the American Felt Dam site.

   To supplement this date, U.S.G.S. Topographic Maps (Scale 1: = 2000') were utilized to develop hydrologic parameters such as drainage areas, reservoir surface areas, basin length, time of concentration and other runoff characteristics. Elevation - storage relationships for the reservoir were approximated. Surcharge storage was computed using U.S.G.S. maps. Some of the pertinent hydraulic design data was obtained and/or confirmed by actual field measurements at the time of the visual field inspection.

b. Outflow values (routing procedures) and dam overtopping analysis were computed in accordance with the guidelines developed by the Corps of Engineers. Judgment was used in calculating final values outlined in this report, which are quite approximate and should not be considered a substitute for actual detailed analysis.

5.3 Experience Data

Historical data for recorded discharges at the dam site is limited to the following approximations derived in 1955 from an unknown source:

July and September 1938 - 2200 cfs
October 1955 - 3000 cfs

From the spillway capacity and dam overtopping analysis calculations, both of these floods overtopped the dam by at least a foot, but were contained by the flood walls.

5.4 Test Flood Analysis

Recommended guidelines for the Safety Inspection of Dams by the Corps of Engineers were used for the selection of the "Test Flood". This dam is classified as a HIGH hazard and a SMALL size structure. Guidelines indicate that 1/2 to 1 times the Probable Maximum Flood (PMF) be used as the test flood for these classifications. A test flood equal to 1/2 PMF was chosen because the dam has a small storage capacity. The watershed has a total area of 25.4 square miles. Snyder's lag was calculated to be 7.00 hours and a Snyder peaking coefficient of 0.625 was used. The 200 square miles - 24 hour probable maximum precipitation (PMP) is 22 inches. The flood hydrograph package, HEC-1 computer program, developed by the Corps of Engineers was utilized to develop the inflow hydrograph, route the flood through the reservoir, and for the dam overtopping analysis. A test flood equal to 1/2 PMF was calculated to have an inflow of 13000 cfs. The outlet works were assumed to be closed and the flood walls on the top of the dam were not considered in this analysis.

The spillway capacity is hydraulically inadequate to pass the test flood (1/2 PMF) and overtopping of the dam and walls will occur. The maximum outflow capacity of the spillway without overtopping the dam is 1335 cfs. This corresponds to 10 percent of the test flood and a storage above the spillway level of 13 ac.-ft. The maximum outflow discharge value for the test flood is 13000 cfs corresponding to a depth of flow over the top of the dam of 7.4 feet and a storage above the spillway level of 36 ac.-ft. A spillway rating curve, outlet works rating curve, and a reservoir surface area - capacity curve are included in Appendix D of this report.

At the spillway crest elevation of 100.0, the capacity of the 12 inch outlet structure is 13 cfs. Since this is less than the normal flow of the Byram River, storage for impending flood conditions cannot be provided if the pool level is high. Use of the 6 inch tap to the 60 inch pipe will not change this situation.

5.5 Dam Failure Analysis

This dam is classified as a HIGH hazard structure. Failure discharge can cause loss of life and damage due to high velocities, impact from debris, and the flooding of 5 to 8 residential homes and industrial buildings of the former American Felt Company. Calculated dam failure discharge is 9479 cfs at a pool level equal to the top of the dam. At this level, the pre-failure flow in the downstream channel will be 1335 cfs equal to the full spillway capacity and a corresponding depth of flow of 1 to 2 feet downstream. Failure will produce a water surface level approximately 15.5

feet immediately downstream from the dam and approximately 10 feet at the factory buildings. The failure discharge will affect downstream areas for a distance of 3000 feet from the dam. At this distance the water surface level will be approximately 6.2 feet above normal observations. Beyond 3000 feet, the effects of the failure discharge will be reduced as it enters the Pemberwick Dam Pond. Water surface elevations due to the failure of the dam are listed in Appendix D. Probable consequences including the prime impact areas, are also listed in Appendix D.

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observation

The visual inspection revealed no signs of major physical distress in the structure. However, seepage is occurring through each abutment, and stones were missing from each wall at the ends of the spillway.

6.2 Design and Construction

There is insufficient design and construction data to permit a formal evaluation of stability. A previous inspection conducted by S. E. Minor and Co., Inc. in 1938 expressed concern for the stability of the structure. The above inspection report is contained in Appendix B of this report.

6.3 Post-Construction Changes

No post-construction design data pertinent to the embankment or foundation is available.

Recommended improvements based on the 1938 inspection appear to have been carried out. These include the construction of the overflow channels, building up of the downstream west face (accomplished by the overflow channel), and extension of the dike at the west end of the dam.

Portions of the crests of the dam were raised in about 1955 by the addition of walls along the downstream edges of the crests.

The earth dike continuing the west crest was built in 1973.

6.4 Seismic Stability

This dam is in Seismic Zone 1 and hence does not require evaluation for seismic stability according to the Corps of Engineers Recommended Guidelines.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

a. **Condition:** Based on the visual inspection, past performance and hydraulic/hydrologic evaluation, the American Felt Dam and appurtenances are judged to be generally in FAIR condition. Items of concern that should be addressed as a result of this inspection are listed in Sections 7.2 and 7.3.

b. **Adequacy of Information:** The absence of existing engineering data did not allow for definitive review. Therefore, the adequacy of the dam is based on visual inspection, past performance history, and engineering judgment.

c. **Urgency:** The recommendations and remedial measures described below should be implemented by the owner within one year after receipt of this Phase I Inspection Report.

7.2 Recommendations

It is recommended that the owner engage a qualified registered engineer to carry out the following actions:

a. A detailed hydrologic-hydraulic investigation to determine the need and means of increasing the discharge capacity of the project.

b. Correction of the leakage occurring from the sluice gate for the 60 inch outlet pipe. This is recommended because the entire 60 inch pipe is under pressure creating a potential flooding hazard, should the pipe rupture.

c. The pond be lowered and the upstream face be visually inspected and the toe checked for potential undermining.

d. Determine the feasibility of providing a low level outlet with a control on the upstream side of the dam.

7.3 Remedial Measures

a. Operational and Maintenance Procedures

1. The vegetation should be removed from the joints and the joints re-pointed on the faces and crest of the dam.

2. The missing stones should be replaced at the edges of the spillway.

3. The seepage on the downstream face should be monitored to note any change from the existing conditions.

4. Develop a formal flood warning and surveillance plan, including round-the-clock monitoring during heavy precipitation.

5. The shrubs and small trees should be removed from the dike.

6. Institute a program of annual periodic technical inspection.

7.4 Alternatives

Remove the dam.

APPENDIX A

INSPECTION CHECK LIST

INSPECTION CHECK LIST

PARTY ORGANIZATION

PROJECT American Felt Dam

DATE November 12, 1979

TIME 1:00 - 3:00

WEATHER Overcast

W.S. ELEV. _____ U.S. _____ DN.S.

PARTY:

1. R. Johnston, JPPA
2. R. Lyon, JPPA
3. G. Salzman, CWDD
4. _____
5. _____
6. D. Knabel - Greenwich Assoc.
7. _____
8. _____
9. _____
10. _____

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Hydraulics	R. Johnston	
2.	Structural	R. Lyon	
3.	Geotechnical	G. Salzman	
4.			
5.			
6.			
7.			
8.			
9.			
10.			

INSPECTION CHECK LIST

PROJECT American Felt Dam DATE 11-12-79

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED		CONDITION
DAM EMBANKMENT		
Crest Elevation	104.7	Good - 4 inch concrete
Current Pool Elevation	100.0	46" Below left crest
Maximum Impoundment to Date		
Surface Cracks		Minor cracking in concrete
Pavement Condition		Good - Minor spalling of concrete
Movement or Settlement of Crest		None observed
Lateral Movement		None observed
Vertical Alignment		Good
Horizontal Alignment		Good
Condition at Abutment and at Concrete Structures		Good
Indications of Movement of Structural Items on Slopes		None observed
Trespassing on Slopes		Not permitted
Vegetation on Slopes		Grass, brush and trees (up to 20")
Sloughing or Erosion of Slopes or Abutments		None observed
Rock Slope Protection - Riprap Failures		None observed
Unusual Movement or Cracking at or near Toes		Toe not visible - underwater
Unusual Embankment or Downstream Seepage		Minor leakage through abutments and various points through masonry on downstream face of dam.
Piping or Boils		None observed
Foundation Drainage Features		None observed
Toe Drains		None observed
Instrumentation System		Continuous water temp. measurements taken from right crest at spillway.

INSPECTION CHECK LIST

PROJECT American Felt Dam DATE 11-12-79

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	
Location	Extension of right dam embankment extending upstream parallel to flow.
Crest	Good - Grass and shrubs on crest
Surface Cracks	N/A
Pavement Condition	N/A
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	N/A
Trespassing on Slopes	Not permitted
Vegetation on Slopes	Grass & shrubs on upstream face
Sloughing or Erosion of Slopes or Abutments	None observed
Rock Slope Protection - Riprap Failures	N/A
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	None observed
Foundation Drainage Features	None observed
Toe Drains	None observed
Instrumentation System	None observed

INSPECTION CHECK LIST

PROJECT American Felt Dam DATE 11-12-79

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	Entire riverbed - under water Silt level approximately 3 ft. below water level in places.
b. 60 inch pipe outlet	Wood rectangular sluicegate approximately 14 ft. below spillway level. Visible portion in good condition and gear lift on top of dam is operable.
c. 12 inch pipe outlet	Free access pipe inlet approximately 12 ft. upstream of dam and 12 ft. below spillway level. Not visible. Controlled by valve in a covered pit on the slope downstream of the dam.
d. Low Level Outlet	Record drawings indicate a wood intake upstream of the dam, not visible. Suspected to be below present silt level and inoperable.

INSPECTION CHECK LIST

PROJECT American Felt Dam DATE 11-12-79

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION & CONDUIT	
a. 60 inch pipe outlet	60 inch pipe leads from the dam to the former American Felt Company Mill Building. A vertical vent pipe just downstream of the dam contains water at about the pond level. 60 inch pipe is sealed in the building but can be drained via a 6 inch line.
b. 12 inch pipe outlet	12 inch pipe leads from the dam to the former American Felt Company Mill Building where it terminates in a blind flange.
c. Low level outlet	Record drawings indicates that the conduit transitions from wood to masonry and extends to the downstream face of the dam. Not visible.

INSPECTION CHECK LIST

PROJECT American Felt Dam DATE 11-12-79

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
a. 60 inch pipe outlet	60 inch pipe is sealed in building. Slight flow maintained via the 6 inch line during high flow conditions. A rectangular masonry channel then continues through the building basement and back to the river. Seapage, apparently groundwater, was occuring from channel walls, approximately 5 gpm
b. 12 inch pipe outlet	Blind flange last opened in 1972 or 1973. Discharges back to the river.
c. Low level outlet	Square masonry opening in downstream face of dam.

INSPECTION CHECK LIST

PROJECT American Felt Dam DATE 11-12-79

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	Entire riverbed - under water
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir and Training Walls	
General Condition of granite	Fair to Good. A few stones missing from wall at sides of spillway
Rust or Staining	N/A
Spalling	None observed
Any Visible Reinforcing	None observed
Any Seepage or Efflorescence	Spillway flowing - None visible
Drain Holes	None observed
c. Discharge Channel	Entire river bed - Underwater
General Condition	Good
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	One
Floor of Channel	Underwater - Apparently rock
Other Obstructions	Bridge approximately 150 ft. downstream of dam.
	Small (7' high) dam a short distance downstream bridge.

APPENDIX B

ENGINEERING DATA

APPENDIX B-1

DESIGN, CONSTRUCTION AND MAINTENANCE RECORDS AND LOCATION

Mr. Victor J. Galgowski
Dam Safety Engineer
Water and Related Resources Unit
Department of Environmental Protection
State of Connecticut
State Office Building
Hartford, Connecticut 06115

Greenwich Associates, Inc.
100 Putnam Green
Greenwich, Connecticut 06830

APPENDIX B-2

COPIES OF PAST INSPECTION REPORTS

NTERDEPARTMENT MESSAGE

TO 200 2/69

SAVE TIME: *Handwritten messages are acceptable.*
Use carbon if you really need a copy

O File	AGENCY Water and Related Resources	DATE September 11, 1972
ROM Victor F. Galgowski Supt. of Dam Maintenance	AGENCY Water and Related Resources	TELEPHONE

BJECT American Felt Company Dam, Greenwich 4 BY3.6

The undersigned inspected this site on April 4, 1972. The dam is well-maintained and appears to be in very good condition. There was three inches of water flowing over the spillway so a close inspection of the face was impossible.

Supt. of Dam Maintenance

VFG:ljg

SAVE TIME: *If convenient, handwrite reply to sender on this same sheet.*

No. _____

WATER RESOURCES COMMISSION
SUPERVISION OF DAMS
INVENTORY DATA

Inventoried By _____

Date 3-8-65

Name of Dam or Pond Millard Auer Felt Dam

Code No. _____

Nearest Street Location Glenville Rd

Town Greenwich (Glenville

U.S.G.S. Quad. Glenville

Name of Stream Byram R

Owner G.A.F.
Address 1361 Alps Road
Wayne, NJ 07470

OK 12/78

Pond Used For DA 25.2 sm

Dimensions of Pond: Width _____ Length _____ Area 2 ac

Total Length of Dam ~~400~~ 200' Length of Spillway ~~40~~ 49'

Location of Spillway ℄ Dam

Height of Pond Above Stream Bed ~~40~~ 30' (35' ~~to bed of s.c.~~ 15' depth/meter 20' silt)

Height of Embankment Above Spillway 4'

Type of Spillway Construction Stone } Heavy Masonry

Type of Dike Construction Stone

Downstream Conditions _____

Summary of File Data _____

Remarks Byram River Flood Project Studies Just Below This Dam - There Fore Some Decision Must Have Been Made (Army C.O.E.)

B-4

Would Failure Cause Damage? Probably To Structure Class 5

Conc. Cap on S.W. + top of dam

Inspected! 4/12/93, [illegible]. Dam [illegible] in [illegible]

[illegible] into [illegible] [illegible] [illegible].
Growth needs to be removed [illegible] [illegible] [illegible], [illegible]
[illegible]. [illegible] [illegible] [illegible].
Base of east tail race wall needs [illegible] [illegible].
Large gate for running water into plant appears to
be in good condition

STATE OF CONNECTICUT
BOARD FOR THE SUPERVISION OF DAMS
DAM SURVEY DATA SHEET

Owner AMERICAN FELT CO.
GLENVILLE ROAD
GLENVILLE, CONN.

Code
Town GREENWICH
Stream BYRAM RIVER
Local Name FELT COMPANY DAM
Date Built 1867

Location Data

Quadrangle — Longitude — Latitude
Watershed WESTCHESTER COUNTY, N.Y. & FAIRFIELD COUNTY, CONN — ROUND HILL BROOK & CONVERSE BROOK

Physical Characteristics

Dam CONCRETE RUBBLE & MASONARY CONSTRUCTION WITH EARTH EMBANKMENTS ON EITHER SIDE. SEE ACCOMPANYING PLAN WITH ELEVATIONS FOR DETAILS.

Spillway MASONARY CONSTRUCTION - NORMAL DISCHARGE THRU 49' WIDE BY 5'-1" HIGH OPENING BETWEEN MAIN ABUTMENTS. SEE PLANS.

Dykes or Butresses MASONARY CONSTRUCTION SEE PLANS.

Foundation APPARENTLY POURED CONCRETE ON LEDGE ROCK.

Stream Bed UPSTREAM - SILT & GRAVEL DOWNSTREAM - MOSTLY LEDGE ROCK.

Pond Area 2.6 ACRES Length 1200'± Width 50' TO 200'

History ORIGINAL DAM OVERTOPPED IN 1877, 1938 AND 1955. SEE REPORTS OF J.W. CONE COMMISSIONER D.P.W. GREENWICH 1950.

Downstream Conditions R.R. & W. DAM ABOUT 3300' DOWNSTREAM WHICH IS ABOUT 1 MILE ABOVE PEMBERWICK FLOOD PLAINS. ABOUT 2½ MILES TO TIDE WATER. AREA BELOW DAM AND PARTICULARLY IN THE FLOOD PLAIN IS DENSELY POPULATED WITH MANY ROADS CROSSING BYRAM RIVER INCLUDING U.S. Nº 1 AT N.Y. STATE LINE.

Condition of Structures PHYSICAL APPEARANCE IS SOUND WITH INDICATIONS OF SOME OPEN JOINTS LACKING MORTAR IN DOWNSTREAM FACE OF SPILLWAY. CONSIDERABLE REPAIR WORK WAS DONE THIS YEAR PRIOR TO OUR INSPECTION.

Watershed Data

General Cover SPARSELY POPULATED — Average Slope 45.2 ft/mile — Area 23.3 SQ. MILES.
Spillway Capacity 49 × 5.1 ½ × 3.2 = 1805 C.F.S. — Expected Flood Discharge 100 YR FLOOD = 3320 C.F.S. (25 YR = 894 C.F.S.)
Freeboard Required — Effective Discharge Depth
Gates or Valves and Sizes 1 GATE ABOUT 2' × 2' — Effective Capacity 14 C.F.S.
Classification PRIMARY STRUCTURE — Use PROCESS WATER & FIRE FIGHTING.

Recommended Construction or Alteration

SPILLWAY & ADJOINING DOWNSTREAM SURFACES SHOULD BE POINTED UP BY A PRESSURE PROCESS. FURTHER INSPECTION SHOULD BE MADE WHEN CONVENIENT TO DEWATER POND FOR INSPECTION OF UPSTREAM FACE OF STRUCTURE.

Inspection Data WEATHER DRY - COLD - CLEAR

Road Location and Nearest Junction GLENVILLE ROAD & PEMBERWICK ROAD - GLENVILLE CONN.

Remarks SEE ATTACHED REPORT WITH REFERENCES TO PAST INSPECTIONS.

Inspection Date OCTOBER 26, 1956
Made By DEAN CLARK
KARL G. JESPERSEN
KARL G. JESPERSEN
COS COB CONN.

S. E. MINOR & CO., INC.
CIVIL ENGINEERS
GREENWICH, CONN.

56 - 1 - 1
from Mr Caldwell's Office

December 15, 1938

COPY

Drainage Commission
Town Hall
Greenwich, Conn.

Re: Byram River Dams

Gentlemen:-

At the request of your Commission, representing the Town of Greenwich, and other interested parties, an inspection was made November 2, 1938 of three dams on the Byram River by a committee of this Board consisting of Messrs. Palmer, Blair and Cone, with particular reference to loss or damage in the Pemberwick flood area should these dams break away.

A study of the watershed to determine probable maximum run-off was made by the writer and field data was obtained under his supervision.

The dams under consideration, in order following downstream, are commonly known as the:- Reynolds Dam, Felt Co. Dam, and R. B. & W. Dam, owned respectively by Grace V. A. Reynolds, The American Felt Co. and Russell, Burdsall & Ward Bolt & Nut Co.

Watershed.

Watershed tributary to the Felt Co. dam is 27.35 sq. mi. and to the R. B. & W. dam 27.75 sq. mi., both approximate. Water is diverted from the watershed at two points; by New York City on the west branch of the Byram at the State Line and on the east branch by the Greenwich Water Co. above Old Mill Road.

Estimated flood flow on July 23, 1938 and Sept. 21, 1938, both of the same magnitude, was approximately 2000 cubic feet per second. Had both tunnels been closed, the flow would have been

approximately 2200 c.f.s.

The watershed, from a runoff viewpoint, is undeveloped. Quicker runoff with higher flood stages is to be expected in the future due to swamp clearance and drainage, construction of storm drains, buildings, pavements, and other impervious surfaces.

Using the Fuller formula with a watershed constant of 60 and time frequency of 1000 a maximum rate of runoff is obtained of 5200 cubic feet per second or more than twice the flood flow of the floods of July and September. This is not an unreasonable flood to expect sometime in the future, particularly considering the comparatively small area of the watershed. Had the center of the hurricane of September passed along the Byram watershed, this flow would have been obtained.

Plans.

No construction plans of the dams are known to be in existence. The Reynolds and Felt Co. dams are evidently by their appearance quite old. The original R. B. & W. dam quite likely failed in the flood of October 9, 1877 when precipitation was 9.7 inches in 10.5 hours at White Plains, N. Y. It is reasonable to presume the present R. B. & W. dam was built shortly thereafter.

Back profiles of sections of dams at maximum height were obtained by sounding from a boat with an iron rod through water and silt, consequently sections are approximate. Condition of toe of R. B. & W. dam was investigated in the same manner.

Reynolds Dam.

This dam is a typical dry rubble overflow dam with vertical

face, originally with a tight-line and probably an impact platform. Abutments are against ledge rock. Headrace ends in a wooden bulkhead in poor condition. Old mill has been razed. The pond formed by the dam is shallow due to silting and impounds about 5 acre feet.

The dam is a small affair in poor condition and unless repaired will go out during some freshet. Failure will be comparatively slow; the dam will not give way all at once. For this reason and since only a small amount of water is retained by the dam, no serious harm will be done.

Felt Co. Dam.

This dam is located 1700'± below the Reynolds dam and 3300'± above the R. B. & W. dam. Principal dimensions are as follows:-

Crest length	200'±
Spillway length	49'
Maximum height at spillway	30'
Top width at spillway	13'
Bottom width at spillway	19'±
Freeboard	4.75 Aver.
Area of pond	2.6± Ac.
Capacity of pond (silted)	6± Ac. ft.

The dam is constructed of cement rubble masonry with a vertical face. The back, as nearly as could be determined by soundings, is stepped. The spillway section is arched in plan with a face radius of 65'. The east abutment has considerable mass and is backed by a retaining wall, perpendicular to the dam, with heavy fill in back of retaining wall and between dam and mill building. The west abutment has not sufficient mass nor is the plan proper to take arch thrust. Consequently the dam should be considered as a gravity section disregarding arch action.

Impact of overflow at spillway is taken by exposed ledge rock and there is no danger of concealed underscour. It is believed the main portion of the dam is on ledge rock. The extreme ends may not be.

The spillway is inadequate. The crest was topped by a few inches during the floods of 1938. If spillway length remains the same and crest length is held to 185' by building up ends, it is probable a future flood would have a still water height of about 2.5' above crest of dam and about 7.3 above spillway. Length of spillway should be increased by extending same to the west.

Under the conditions stated above and considered as a gravity section, the resultant of forces acting on the dam falls well outside the middle third and while the dam is theoretically safe against overturning, there is probable tension in masonry in the back of the dam. There is not the margin of safety indicated by good practice, particularly when the condition of the masonry in the interior of the dam is unknown. The dam can be strengthened by additional masonry along the downstream face.

Trees have been allowed to grow on and close to the dam. This should not be allowed account of root action.

There is a collecting trough along the east portion of the dam to take overtopping. If this was not included in the original design, it was built as the result of some experience in the past. The bottom of this trough should be paved to prevent scouring.

If the building on the downstream side of the west end of

the dam is to be protected, a similar trough should be constructed along the west portion of the dam.

An extraordinary flood would probably cut around the ends of the dam, particularly the west end. This might result in progressive undermining of the ends of the dam and final failure. To prevent this, ends of dam should be raised and carried back into solid ground.

There is a leak through the bottom of the sluiceway under the easterly portion of the spillway. This should be repaired. The old sluiceway in the western portion of the dam is not used and should be closed with masonry.

The fact that a dam has stood for a long period of years should not of itself give assurance the dam will withstand all future floods. To refute this idea there is the evidence, throughout New England, of numerous neglected dams that have failed. An old dam requires frequent and thorough maintenance. Moreover, it is quite probable the particular watershed has not been subject to a serious flood condition for a period far beyond the memory of the oldest inhabitant.

To place the dam in better condition the following is recommended:- Lengthen spillway - Additional masonry to increase section - Remove trees - Pave east collecting trough - Construct similar trough along west end - Build up ends of dam to prevent end scour - Repair leak - Close up old sluiceway - Careful maintenance.

The volume impounded by this dam is small, the distance to the R. I. & W. dam is 3300 feet mostly still water, area

of the R. B. & W. pond is 5.5± acres, surge would flatten out quickly and still water level at the R. B. & W. dam would be only slightly raised. Should the dam fail, loss or damage would be confined to the American Felt Co. and the Pemberwick flood plain would not suffer loss or damage.

R. B. & W. Dam.

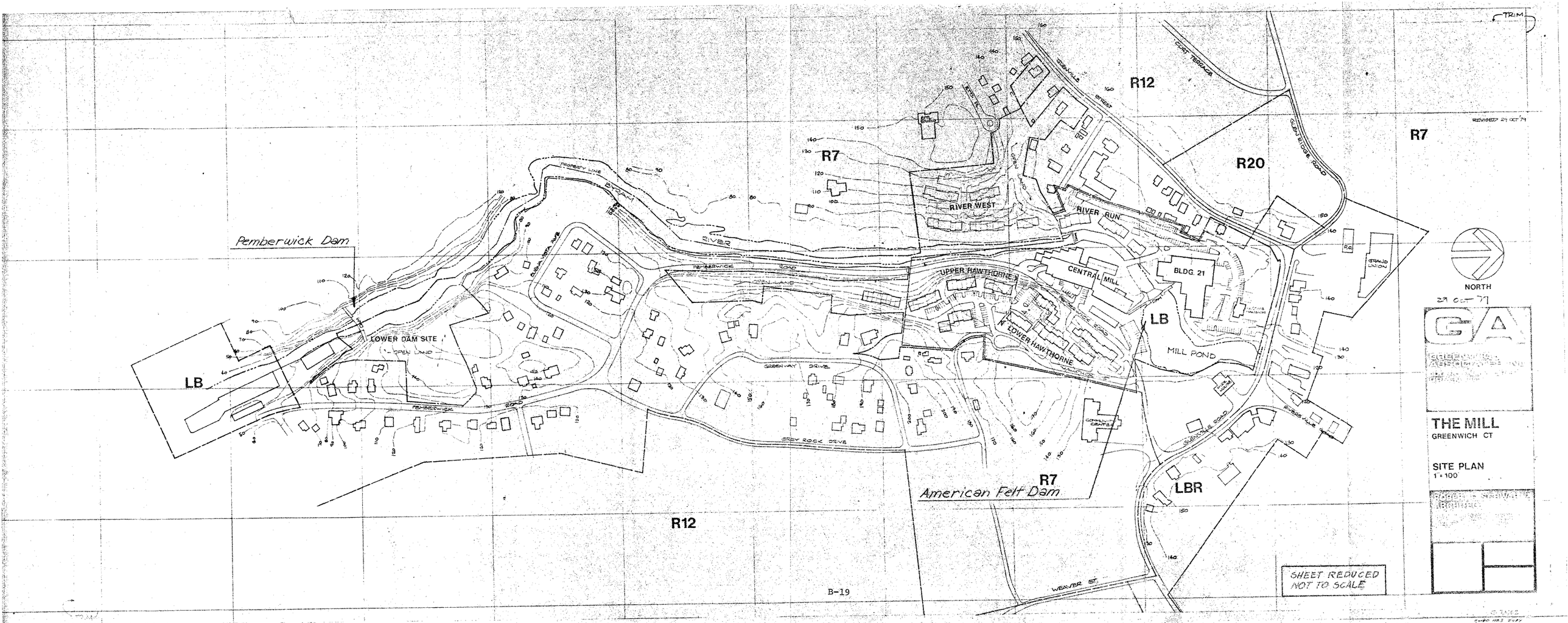
This dam is located 3300'± below the Felt Co. dam and immediately above the flood plain section of "Pemberwick". Principal dimensions are as follows:-

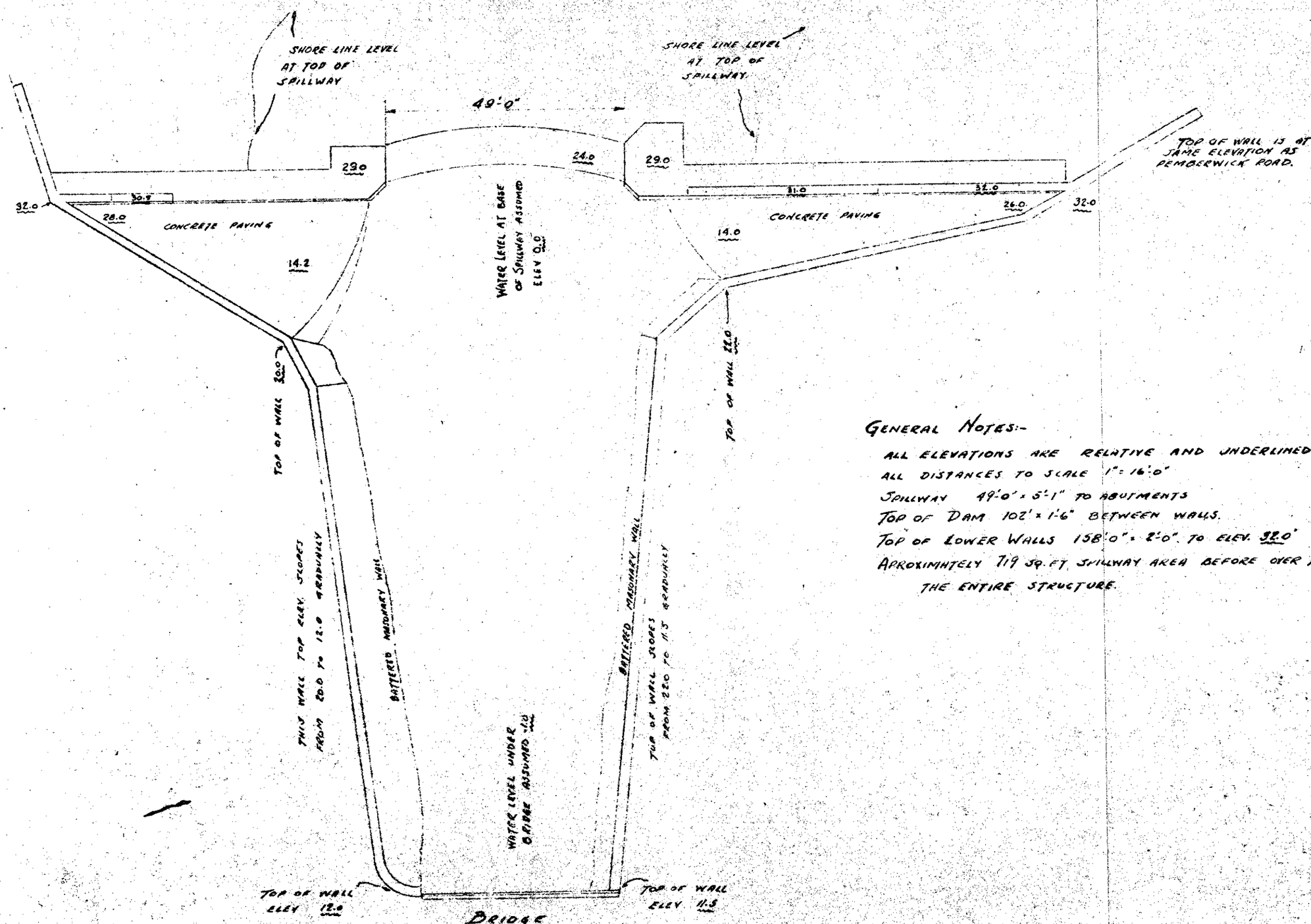
Crest length	115'
Spillway length	63'
Maximum height at spillway	41'
Top width at spillway	8'
Bottom width at spillway	17'±
Freeboard	3.5
Area of pond	5.5± Ac.
Capacity of pond (silted)	29± Ac. ft.

This is an arch dam, between ledge rock abutments, in a narrow gorge with nearly vertical sides. Face of dam is vertical and face radius of arch is 180'±. Face masonry is coursed ashlar and is a wonderful piece of work. Entire visible portion of dam is on ledge rock. As nearly as could be determined by sounding with iron rods from a boat in the spillway pool, overflow impact is taken by ledge rock and there was no underscouring of the dam that could be found by prodding.

Still water height over spillway during recent floods was 4.3'±. The entire length of the dam acts as an overflow dam during floods with no danger of end scour.

The dam is safe in its present condition and will withstand


Pemberwick Dam
LOWER DAM SITE
OPEN LAND
LB
R12
R7
RIVER WEST
RIVER RUN
R20
R12
R7
UPPER HAWTHORNE
CENTRAL MILL
BLDG. 21
LB
LOWER HAWTHORNE
MILL POND
GRANO UNION
NORTH
29 Oct 77
GA
THE MILL
GREENWICH CT
SITE PLAN
1" = 100'
R7
American Felt Dam
LBR
SHEET REDUCED
NOT TO SCALE
PEMBERWICK ROAD
GREEN WAY DRIVE
GREY ROCK DRIVE
GLENRIDGE ROAD
CURT TERRACE
GLENVILLE STREET
WEAVER ST.
PROPERTY LINE
RIVER
TRIM



General Notes:-

ALL ELEVATIONS ARE RELATIVE AND UNDERLINED THUS ___

ALL DISTANCES TO SCALE 1" = 16'-0"

SPILLWAY 49'-0" x 5'-1" TO ABUTMENTS

TOP OF DAM 102' x 1'-6" BETWEEN WALLS.

TOP OF LOWER WALLS 158'-0" x 2'-0". TO ELEV. 32.0'

APPROXIMATELY 719 SQ. FT. SPILLWAY AREA BEFORE OVER TOPPING THE ENTIRE STRUCTURE.

B-20

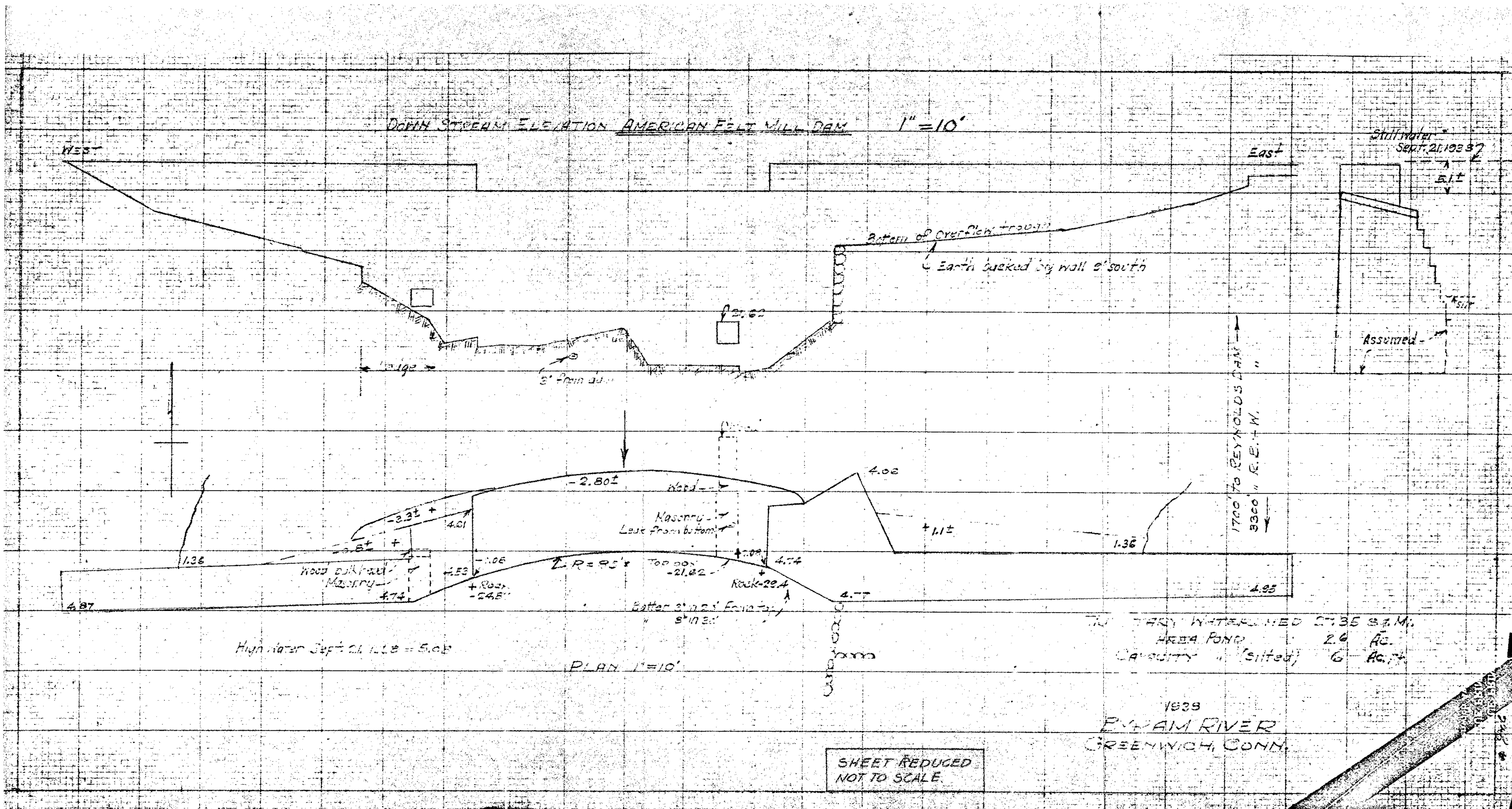
SHEET REDUCED NOT TO SCALE

STATE OF CONNECTICUT
BOARD FOR THE SUPERVISION OF DAMS
DAM SURVEY DATA SHEET
Owner: AMERICAN FELT CO.
GLENVILLE, CONN.

Code
Town GREENWICH
Stream BYRAM RIVER
Local Name FELT COMPANY DAM
Date Built 1867

KARL C. JESPERSEN
COS COB, CONN.

NOVEMBER 10 1936


DOWN STREAM ELEVATION AMERICAN FELT MILL DAM 1" = 10'
West
East
Still water Sept. 21, 1938
Bottom of Overflow trough
Earth backed by wall 2' south
Assumed
1700' to REYNOLDS DAM
3300' " R.R. - W.
-2.80±
4.02
Wood
Masonry
Leak from bottom
4.01
-2.3±
1.1±
1.36
1.38
Wood bulkhead
Masonry
4.74
4.53
-1.06
R = 95'±
Top dam -21.62
Rock-22.4
4.74
4.77
4.95
4.87
Batter 3" in 2' Foundation
High Water Sept. 21, 1938 = 5.08
PLAN 1" = 10'
Area Pond 2.6 Ac.
Capacity " (Silted) 6 Ac.ft.
1939
BYRAM RIVER
GREENWICH, CONN.
SHEET REDUCED
NOT TO SCALE

any flood it is reasonable to expect.

The stability of this type of dam, among other things, depends on tight contact with gorge walls and constant inter-contact of the various sections of the dam; and of course, as with any dam, underscouring must be prevented. Consequently this dam must be inspected periodically to determine (1) that gorge walls are not softening and that no leaks are developing around ends or along bottom; (2) that mortar in masonry joints has not seriously deteriorated and is in good condition; (3) that underscouring is not taking place.

It is recommended that the spillway pool be dewatered during the next low water stage of the river to determine by visual inspection the exact condition of the dam and foundation at the toe in the pool, and to determine whether or not repairs are necessary.

Conclusion.

It is our opinion that:-

The Reynolds dam is in poor condition and will fail during some freshet but the Pemberwick Section will not suffer loss or damage on account of such failure.

The Felt Co. dam may fail during some future flood but the Pemberwick Section will not suffer loss or damage on account of such failure.

The R. B. & W. dam is safe at present and will not

fail under the action of any flood it is reasonable to expect, provided the dam is maintained in good condition.

Yours very truly,

State Board of Civil Engineers

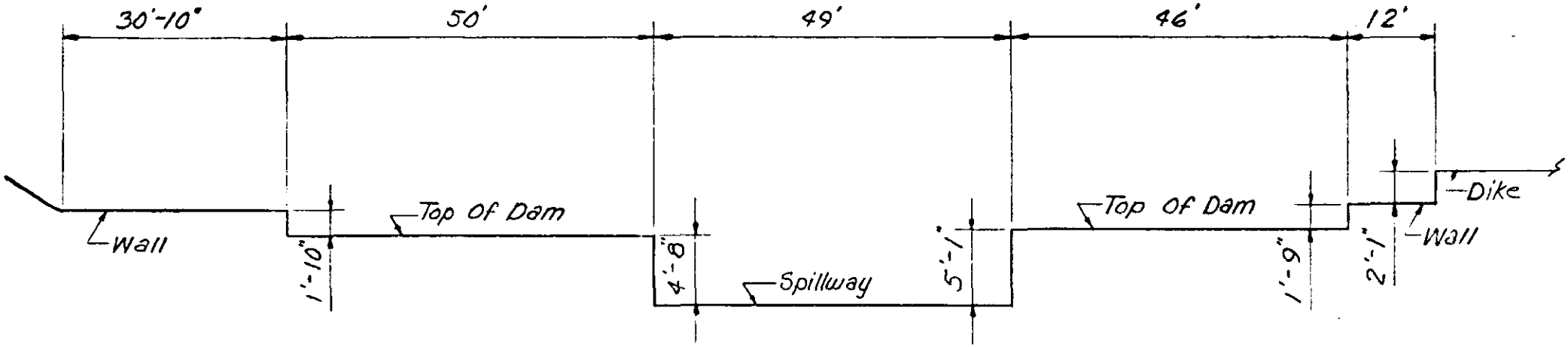
By _____
Joseph [illegible]. Cone
Member for Fourth District

Concurred in _____
Shepard B. Palmer
Member for Second District

_____
Clarence M. Blair
Member for Third District

APPENDIX B-3

RECORD DRAWINGS AND SKETCHES



B-16

NOTE:
All Dimensions Shown
Are Plus Or Minus

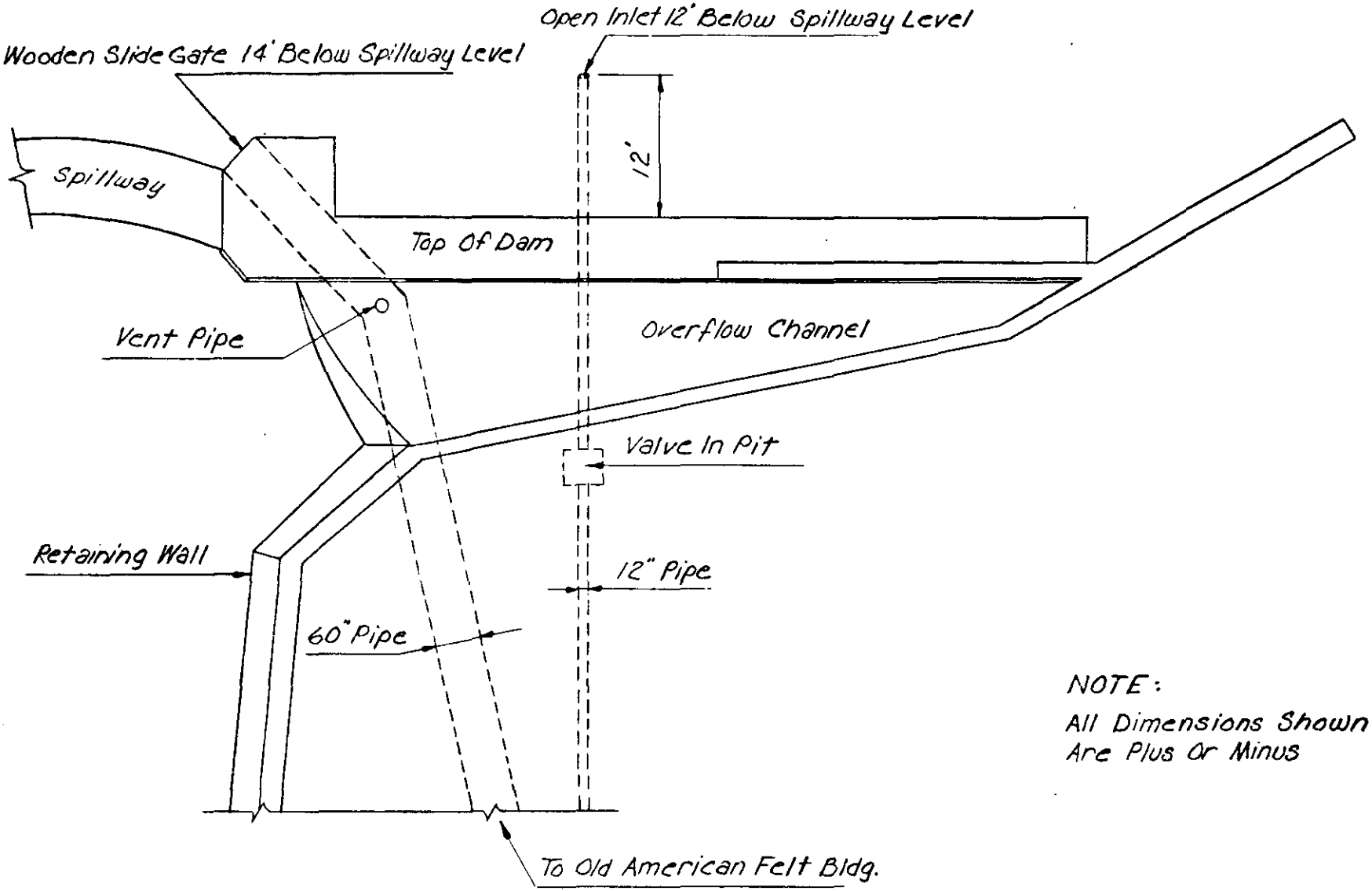
PROFILE ALONG TOP OF DAM

LOOKING DOWNSTREAM

SCALE : HORIZ. 1"=20'
VERT. 1"=10'

AMERICAN FELT DAM

JAMES P. PURCELL ASSOCIATES, INC.
ENGINEERS • ARCHITECTS • PLANNERS



NOTE:
All Dimensions Shown
Are Plus Or Minus

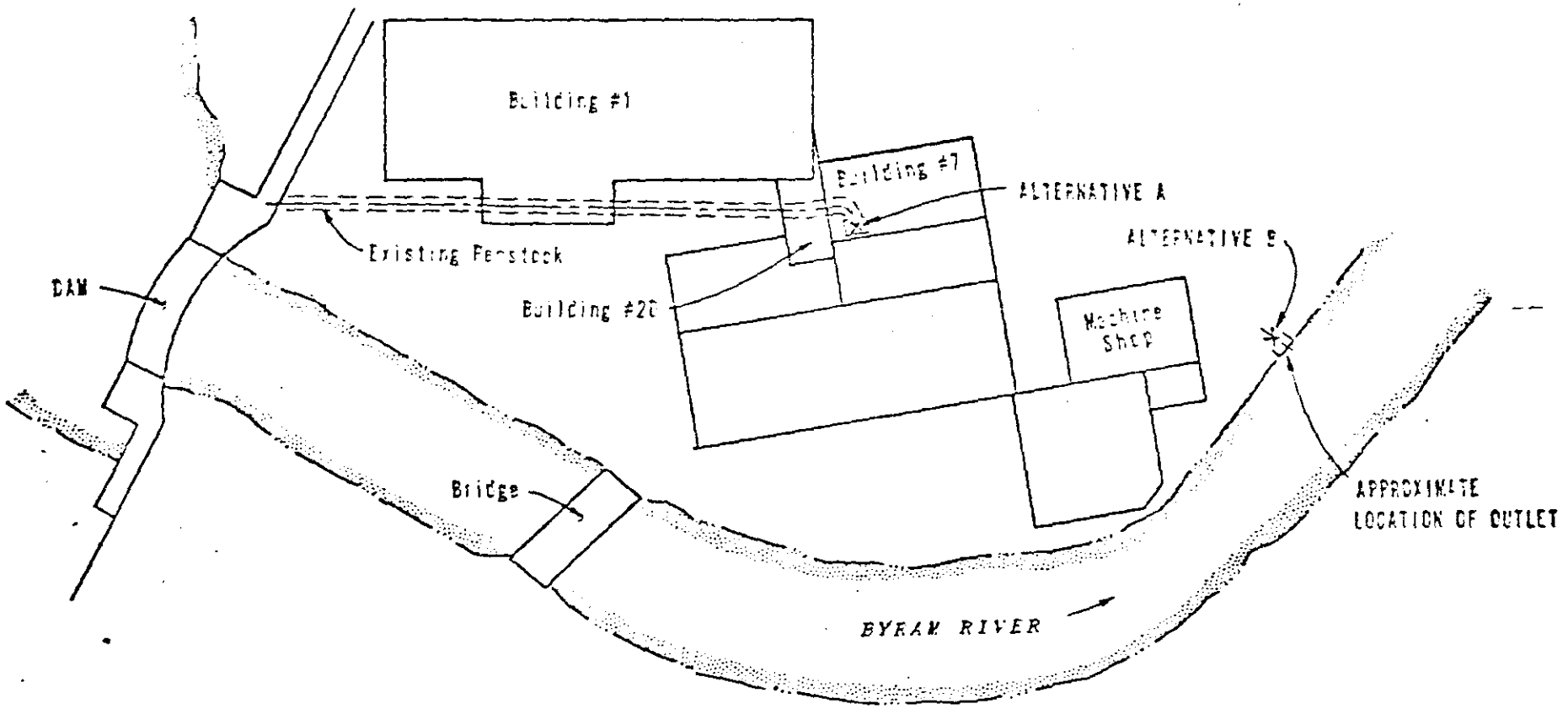
B-17

PLAN OF EAST EMBANKMENT

SCALE: 1"=16'

AMERICAN FELT DAM

JAMES P. PURCELL ASSOCIATES, INC.
ENGINEERS • ARCHITECTS • PLANNERS



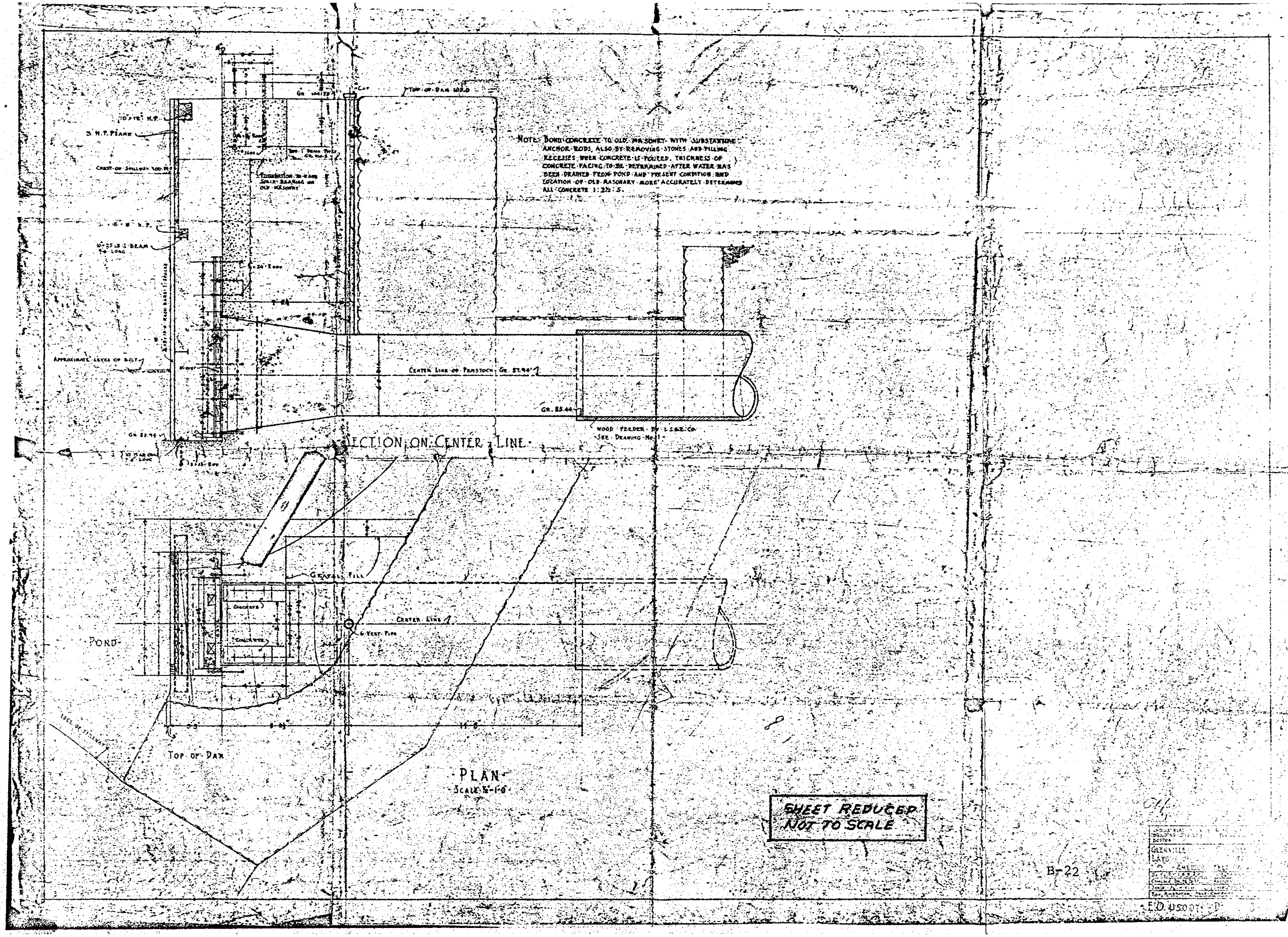
GREENWICH ASSOCIATES, INC.

FELT FACTORY HYDROELECTRIC PROJECT

GENERAL PLAN

DEVELOPMENT AND RESOURCES CORPORATION
New York - Washington - Sacramento

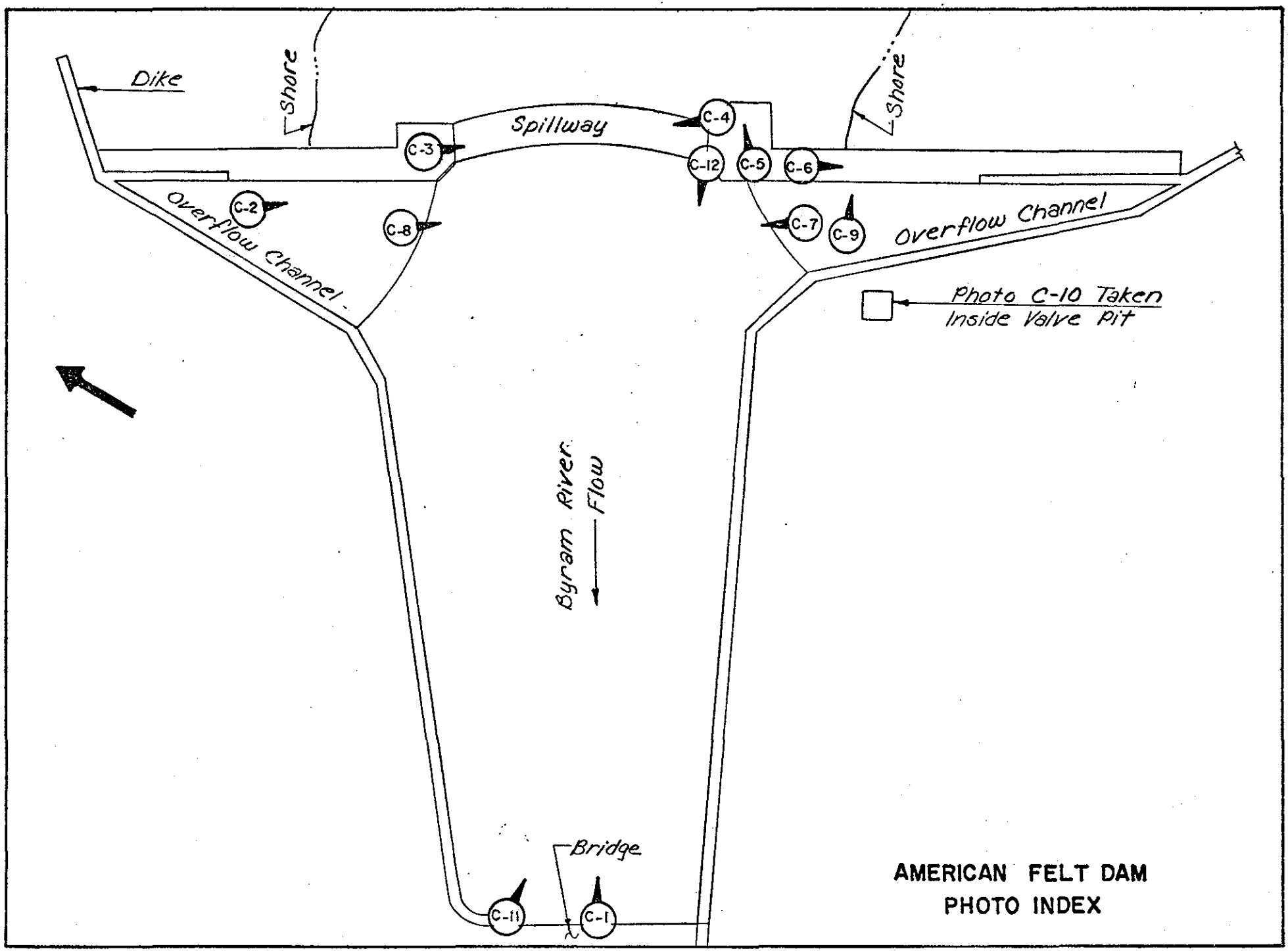
Figure 1



Top of Dam 102.0
Note: Bond concrete to old masonry with substantial anchor rods, also by removing stones and filling recesses when concrete is poured. Thickness of concrete facing to be determined after water has been drained from pond and present condition and location of old masonry more accurately determined.
All concrete 1:2½:5.
3 H.T. Plank
Crest of Spillway
Approximate level of silt
Center Line of Penstock
Wood Feeder by L.S.&E.Co.
See Drawing No. 1
Section on Center Line
Gravel Fill
Concrete
Center Line
6" Vent Pipe
Pond
Top of Dam
Plan
Scale
SHEET REDUCED NOT TO SCALE
B-22

APPENDIX C

PHOTOGRAPHS

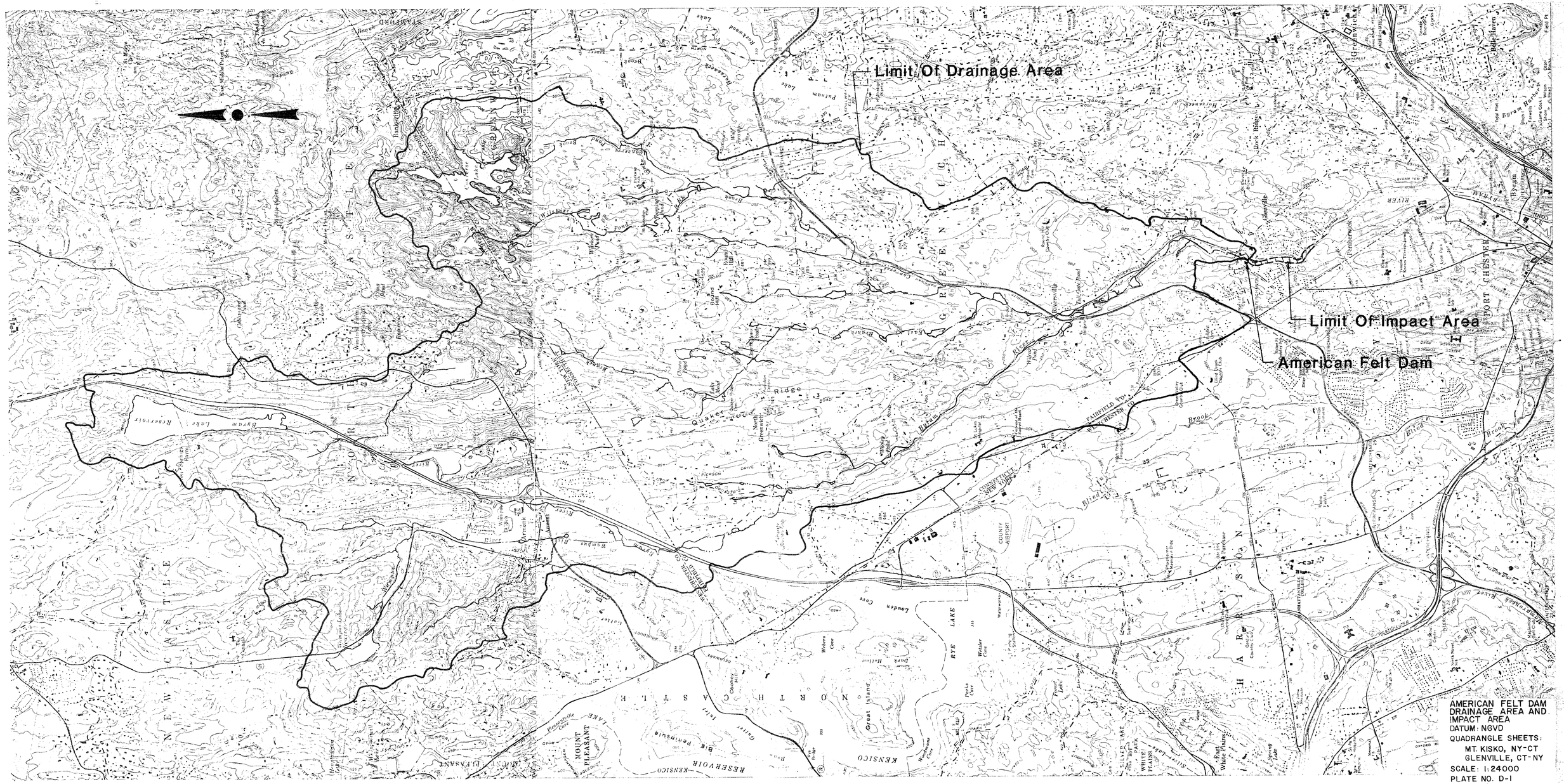

Dike
Shore
Spillway
Shore
C-4
C-3
C-12
C-5
C-6
C-2
C-8
C-7
C-9
Overflow Channel
Overflow Channel
Photo C-10 Taken
Inside Valve Pit
Byram River
Flow
Bridge
C-11
C-1
AMERICAN FELT DAM
PHOTO INDEX

C-7 WEST OVERFLOW CHANNEL

C-8 EAST OVERFLOW CHANNEL

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS


Limit Of Drainage Area
Limit Of Impact Area
American Felt Dam
AMERICAN FELT DAM
DRAINAGE AREA AND
IMPACT AREA
DATUM: NGVD
QUADRANGLE SHEETS:
MT. KISKO, NY-CT
GLENVILLE, CT-NY
SCALE: 1:24000
PLATE NO. D-1

FINAL

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
    1                A1       DAM SAFETY ANALYSIS-JOB NO. 79-905/03-ERJ
    2                A2       AMERICAN FELT DAM-GREENWICH-CT
    3                A3       12-06-79
    4                R     75        1        0        0        0        0        0        2        0        0
    5                B1     5
    6                J      1        2        1
    7                J1    .5       1.        0        0        0        0        0        0        0
    8                K      0        1        0        0        0        0        1        0
    9                K1       COMPUTATION OF PMF-DEVELOPMENT OF INFLOW HYDROGRAPH
   10                M      1        1     25.4        0     25.4        0        0        0        1
   11                P      0       22      100      114      124      132
   12                T      0        0        0        0        0        0        0       .1
   13                W    7.0     .625
   14                X    1.5      .05      2.0
   15                K      1        1        0        0        0        0        1
   16                K1       ROUTING INFLOW HYDROGRAPH THRU LAKE-OVERTOPPING ANALYSIS
   17                Y      0        0        0        1        1
   18                Y1     1        0        0        0        0        0       -1
   19                $A   2.6      3.2        6
   20                $E   100      110      120
   21                $$   100       49      2.7      1.5
   22                $D 104.7      2.7      1.5      139
   23                K     99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1
ROUTE HYDROGRAPH TO	1
END OF NETWORK	

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

RUN DATE= 12/06/79.
TIME= 14.58.01.

DAM SAFETY ANALYSIS-JOB NO. 79-905/03-ERJ
AMERICAN FELT DAM-GREENWICH-CT
12-06-79

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
75	1	0	0	0	0	0	2	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1
RTIOS= .50 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

COMPUTATION OF PMF-DEVELOPMENT OF INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	25.40	0.00	25.40	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.00	100.00	114.00	124.00	132.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .830

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	0.00	.10	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 7.00 CP= .63 NTA= 0

RECESSION DATA
STRTQ= 1.50 QRCSN= .05 RTIOR= 2.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 7.86 AND R= 6.36 INTERVALS

UNIT HYDROGRAPH 38 END-OF-PERIOD ORDINATES, LAG= 6.96 HOURS, CP= .63 VOL= 1.00

77.	282.	562.	876.	1174.	1389.	1496.	1473.	1320.	1128.
963.	823.	703.	600.	513.	438.	374.	320.	273.	233.

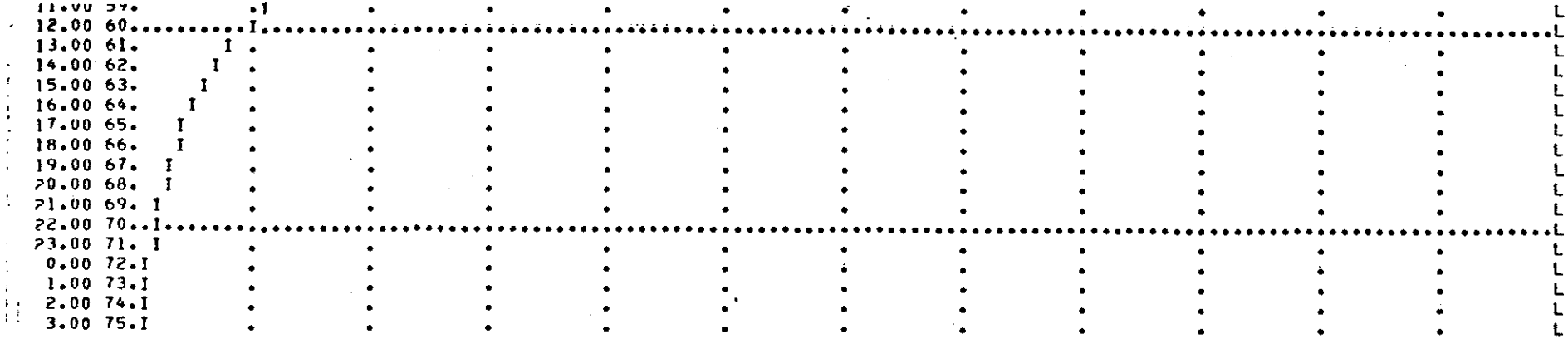
1.01	1.00	1	.01	0.00	.01	1.	1.02	14.00	38	2.19	2.09	.10	3126.
1.01	2.00	2	.01	0.00	.01	1.	1.02	15.00	39	2.74	2.64	.10	4459.
1.01	3.00	3	.01	0.00	.01	1.	1.02	16.00	40	6.94	6.84	.10	6711.
1.01	4.00	4	.01	0.00	.01	1.	1.02	17.00	41	2.56	2.46	.10	10125.
1.01	5.00	5	.01	0.00	.01	1.	1.02	18.00	42	2.01	1.91	.10	14313.
1.01	6.00	6	.01	0.00	.01	1.	1.02	19.00	43	.18	.08	.10	18696.
1.01	7.00	7	.03	0.00	.03	1.	1.02	20.00	44	.18	.08	.10	22516.
1.01	8.00	8	.03	0.00	.03	1.	1.02	21.00	45	.18	.08	.10	25063.
1.01	9.00	9	.03	0.00	.03	1.	1.02	22.00	46	.18	.08	.10	26018.
1.01	10.00	10	.03	0.00	.03	1.	1.02	23.00	47	.18	.08	.10	25340.
1.01	11.00	11	.03	0.00	.03	1.	1.03	0.00	48	.18	.08	.10	23288.
1.01	12.00	12	.03	0.00	.03	1.	1.03	1.00	49	0.00	0.00	0.00	20587.
1.01	13.00	13	.12	.02	.10	2.	1.03	2.00	50	0.00	0.00	0.00	17871.
1.01	14.00	14	.14	.04	.10	9.	1.03	3.00	51	0.00	0.00	0.00	15412.
1.01	15.00	15	.18	.08	.10	28.	1.03	4.00	52	0.00	0.00	0.00	13278.
1.01	16.00	16	.45	.35	.10	88.	1.03	5.00	53	0.00	0.00	0.00	11420.
1.01	17.00	17	.17	.07	.10	204.	1.03	6.00	54	0.00	0.00	0.00	9798.
1.01	18.00	18	.13	.03	.10	357.	1.03	7.00	55	0.00	0.00	0.00	8390.
1.01	19.00	19	.01	0.00	.01	525.	1.03	8.00	56	0.00	0.00	0.00	7171.
1.01	20.00	20	.01	0.00	.01	677.	1.03	9.00	57	0.00	0.00	0.00	6125.
1.01	21.00	21	.01	0.00	.01	786.	1.03	10.00	58	0.00	0.00	0.00	5232.
1.01	22.00	22	.01	0.00	.01	834.	1.03	11.00	59	0.00	0.00	0.00	4469.
1.01	23.00	23	.01	0.00	.01	817.	1.03	12.00	60	0.00	0.00	0.00	3818.
1.02	0.00	24	.01	0.00	.01	741.	1.03	13.00	61	0.00	0.00	0.00	3261.
1.02	1.00	25	.12	.02	.10	644.	1.03	14.00	62	0.00	0.00	0.00	2786.
1.02	2.00	26	.12	.02	.10	559.	1.03	15.00	63	0.00	0.00	0.00	2379.
1.02	3.00	27	.12	.02	.10	491.	1.03	16.00	64	0.00	0.00	0.00	2032.
1.02	4.00	28	.12	.02	.10	441.	1.03	17.00	65	0.00	0.00	0.00	1736.
1.02	5.00	29	.12	.02	.10	408.	1.03	18.00	66	0.00	0.00	0.00	1482.
1.02	6.00	30	.12	.02	.10	388.	1.03	19.00	67	0.00	0.00	0.00	1266.
1.02	7.00	31	.43	.33	.10	402.	1.03	20.00	68	0.00	0.00	0.00	1081.
1.02	8.00	32	.43	.33	.10	483.	1.03	21.00	69	0.00	0.00	0.00	920.
1.02	9.00	33	.43	.33	.10	652.	1.03	22.00	70	0.00	0.00	0.00	782.
1.02	10.00	34	.43	.33	.10	916.	1.03	23.00	71	0.00	0.00	0.00	664.
1.02	11.00	35	.43	.33	.10	1272.	1.04	0.00	72	0.00	0.00	0.00	563.
1.02	12.00	36	.43	.33	.10	1694.	1.04	1.00	73	0.00	0.00	0.00	477.
1.02	13.00	37	1.83	1.73	.10	2255.	1.04	2.00	74	0.00	0.00	0.00	404.
							1.04	3.00	75	0.00	0.00	0.00	325.
									SUM	24.12	20.83	3.28	339069.
										(613.)	(529.)	(83.)	(9601.36)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	26018.	23645.	12763.	4707.	338902.
CMS	737.	670.	361.	133.	9597.
INCHES		8.66	18.70	20.69	20.69
MM		219.95	474.91	525.43	525.43
AC-FT		11725.	25315.	28008.	28008.
THOUS CU M		14462.	31226.	34548.	34548.

STATION 1

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

	0.	4000.	8000.	12000.	16000.	20000.	24000.	28000.	0.	0.	0.	0.	0.
											PRECIP(L) AND EXCESS(X)		
	0.	0.	0.	0.	0.	0.	0.	0.	8.	6.	4.	2.	0.
1.00	1I												L
2.00	2I												L
3.00	3I												L
4.00	4I												L
5.00	5I												L
6.00	6I												L
7.00	7I												L
8.00	8I												L
9.00	9I												L
10.00	10I												L
11.00	11I												L
12.00	12I												L
13.00	13I												LX
14.00	14I												LX
15.00	15I												LX
16.00	16I												LXX
17.00	17.I												LX
18.00	18.I												LX
19.00	19.I												L
20.00	20..I												L
21.00	21. I												L
22.00	22. I												L
23.00	23. I												L
0.00	24. I												L
1.00	25. I												LX
2.00	26.I												LX
3.00	27.I												LX
4.00	28.I												LX
5.00	29.I												LX
6.00	30.I												LX
7.00	31.I												LXX
8.00	32.I												LXX
9.00	33. I												LXX
10.00	34. I												LXX
11.00	35. I												LXX
12.00	36. I												LXX
13.00	37. I												LXXXXXXXXX
14.00	38. I												LXXXXXXXXXX
15.00	39. I												LXXXXXXXXXXX
16.00	40. I												LXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
17.00	41. I												LXXXXXXXXXXXX
18.00	42. I												LXXXXXXXXX
19.00	43. I												LX
20.00	44. I												LX
21.00	45. I												LX
22.00	46. I												LX
23.00	47. I												LX
0.00	48. I												LX
1.00	49. I												L
2.00	50. I												L
3.00	51. I												L
4.00	52. I												


11.00 59.
12.00 60.
13.00 61.
14.00 62.
15.00 63.
16.00 64.
17.00 65.
18.00 66.
19.00 67.
20.00 68.
21.00 69.
22.00 70.
23.00 71.
0.00 72.
1.00 73.
2.00 74.
3.00 75.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 1

1.	1.	1.	1.	1.	0.	0.	0.	0.	0.
0.	0.	1.	4.	14.	44.	102.	179.	262.	339.
393.	417.	408.	370.	322.	279.	245.	221.	204.	194.
201.	241.	326.	458.	636.	847.	1128.	1563.	2230.	3355.
5062.	7157.	9348.	11258.	12532.	13009.	12670.	11644.	10293.	8935.
7706.	6639.	5710.	4899.	4195.	3586.	3063.	2616.	2235.	1909.
1631.	1393.	1190.	1016.	868.	741.	633.	541.	460.	391.
332.	282.	239.	202.	162.					

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13009.	11822.	6382.	2353.	169451.
CMS	368.	335.	181.	67.	4798.
INCHES		4.33	9.35	10.34	10.34
MM		109.97	237.45	262.71	262.72
AC-FT		5862.	12658.	14004.	14004.
THOUS CU M		7231.	15613.	17274.	17274.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 2

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	9.	28.	88.	204.	357.	525.	677.
786.	834.	817.	741.	644.	559.	491.	441.	408.	388.
402.	483.	652.	916.	1272.	1694.	2255.	3126.	4459.	6711.
10125.	14313.	18696.	22516.	25063.	26018.	25340.	23288.	20587.	17871.
15412.	13278.	11420.	9798.	8390.	7171.	6125.	5232.	4469.	3818.
3261.	2786.	2379.	2032.	1736.	1482.	1266.	1081.	920.	782.
664.	563.	477.	404.	325.					

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	26018.	23645.	12763.	4707.	338902.
CMS	737.	670.	361.	133.	9597.
INCHES		8.66	18.70	20.69	20.69
MM		219.95	474.91	525.43	525.43
AC-FT		11725.	25315.	28008.	28008.
THOUS CU M		14462.	31226.	34548.	34548.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTING INFLOW HYDROGRAPH THRU LAKE-OVERTOPPING ANALYSIS

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

SURFACE AREA= 3. 3. 6.

DAM DATA

TOPEL	COQD	EXPD	DAMWID
104.7	2.7	1.5	139.

STATION 1, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	1.	1.	1.	1.	0.	0.	0.
0.	0.	1.	2.	9.	34.	89.	166.	251.	330.
388.	416.	411.	376.	328.	284.	249.	223.	206.	195.
199.	234.	313.	441.	616.	826.	1100.	1530.	2210.	3308.
5022.	7104.	9310.	11219.	12518.	13003.	12690.	11666.	10325.	8958.
7733.	6658.	5733.	4914.	4214.	3599.	3078.	2627.	2248.	1919.
1643.	1404.	1209.	1028.	882.	751.	644.	549.	468.	398.
339.	288.	244.	207.	169.					

STORAGE

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	2.	3.	4.	5.
5.	6.	6.	5.	5.	4.	4.	4.	4.	3.
3.	4.	5.	6.	7.	9.	11.	14.	16.	19.
22.	26.	30.	33.	35.	36.	35.	34.	32.	29.
27.	25.	24.	22.	21.	19.	18.	17.	16.	15.
14.	13.	12.	11.	10.	9.	8.	7.	6.	6.
5.	4.	4.	4.	3.					

STAGE

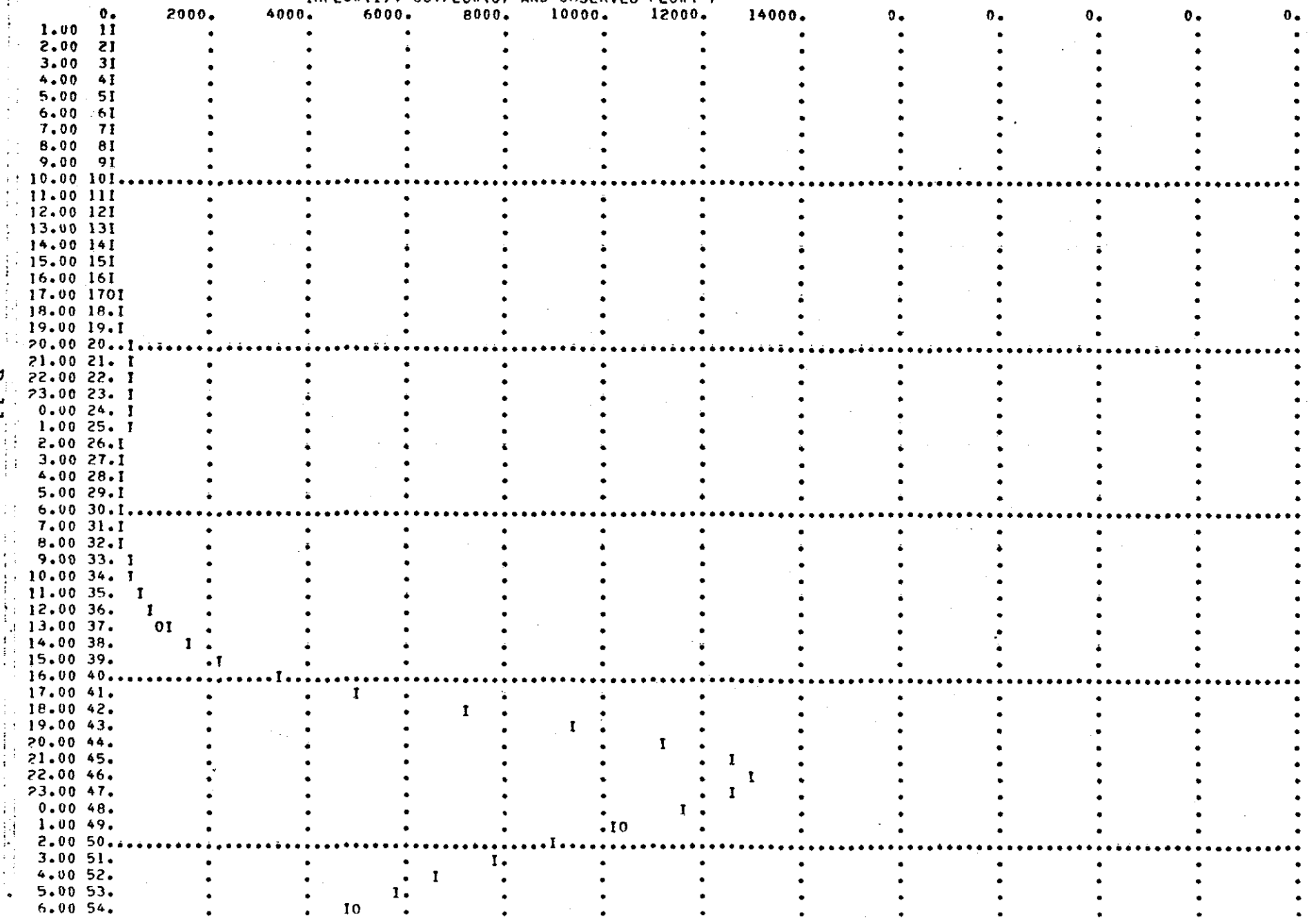
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
100.0	100.0	100.0	100.1	100.2	100.4	100.8	101.2	101.5	101.8
102.0	102.1	102.1	102.0	101.8	101.7	101.5	101.4	101.3	101.3
101.3	101.5	101.8	102.2	102.8	103.4	104.1	105.0	105.7	106.7
107.9	109.1	110.3	111.2	111.8	112.0	111.9	111.4	110.8	110.1
109.5	108.9	108.3	107.8	107.3	106.9	106.5	106.1	105.8	105.4
105.1	104.8	104.4	103.9	103.5	103.2	102.9	102.6	102.3	102.1
101.9	101.7	101.5	101.3	101.2					

PEAK OUTFLOW IS 13003. AT TIME 46.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13003.	11819.	6382.	2353.	169414.
CMS	368.	335.	181.	67.	4797.
INCHES		4.33	9.35	10.34	10.34
MM		109.94	237.46	262.66	262.66
AC-FT		5861.	12658.	14001.	14001.
THOUS CU M		7229.	15614.	17270.	17270.

STATION 1

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)



```
13.00 61.        I  .
14.00 62.       I   .         .         .         .         .         .         .         .         .         .         .         .
15.00 63.      I    .         .         .         .         .         .         .         .         .         .         .         .
16.00 64.     I     .         .         .         .         .         .         .         .         .         .         .         .
17.00 65.    I      .         .         .         .         .         .         .         .         .         .         .         .
18.00 66.    I      .         .         .         .         .         .         .         .         .         .         .         .
19.00 67.  I        .         .         .         .         .         .         .         .         .         .         .         .
20.00 68.  I        .         .         .         .         .         .         .         .         .         .         .         .
21.00 69. I         .         .         .         .         .         .         .         .         .         .         .         .
22.00 70..I.......................................................................................................................
23.00 71. I         .         .         .         .         .         .         .         .         .         .         .         .
 0.00 72.I          .         .         .         .         .         .         .         .         .         .         .         .
 1.00 73.I          .         .         .         .         .         .         .         .         .         .         .         .
 2.00 74.I          .         .         .         .         .         .         .         .         .         .         .         .
 3.00 75.I          .         .         .         .         .         .         .         .         .         .         .         .
```

STATION 1, PLAN 1, RATIO 2

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	5.	21.	71.	183.	338.	506.	663.
777.	832.	821.	750.	654.	567.	497.	446.	411.	390.
398.	470.	631.	888.	1239.	1676.	2232.	3096.	4419.	6648.
10047.	14222.	18606.	22442.	25025.	26013.	25373.	23344.	20647.	17925.
15459.	13318.	11455.	9828.	8416.	7195.	6147.	5252.	4487.	3833.
3276.	2799.	2391.	2043.	1747.	1493.	1282.	1096.	933.	794.
675.	573.	486.	412.	335.					

STORAGE

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	2.	3.	5.	7.	8.
9.	9.	9.	9.	8.	7.	6.	6.	6.	5.
6.	6.	8.	10.	12.	14.	16.	18.	21.	25.
31.	38.	46.	52.	57.	59.	57.	54.	49.	44.
40.	37.	33.	31.	28.	26.	24.	23.	21.	20.
19.	17.	16.	15.	14.	14.	12.	11.	10.	9.
8.	7.	6.	6.	5.					

STAGE

100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
100.0	100.0	100.0	100.1	100.3	100.7	101.2	101.9	102.4	102.9
103.3	103.4	103.4	103.2	102.9	102.6	102.4	102.2	102.1	102.1
102.1	102.3	102.8	103.6	104.4	105.2	105.8	106.5	107.5	108.8
110.7	112.6	114.4	115.9	116.8	117.2	117.0	116.2	115.2	114.1
113.1	112.2	111.3	110.5	109.8	109.2	108.6	108.0	107.5	107.1
106.6	106.3	105.9	105.6	105.3	104.9	104.5	104.1	103.7	103.3
103.0	102.7	102.4	102.1	101.9					

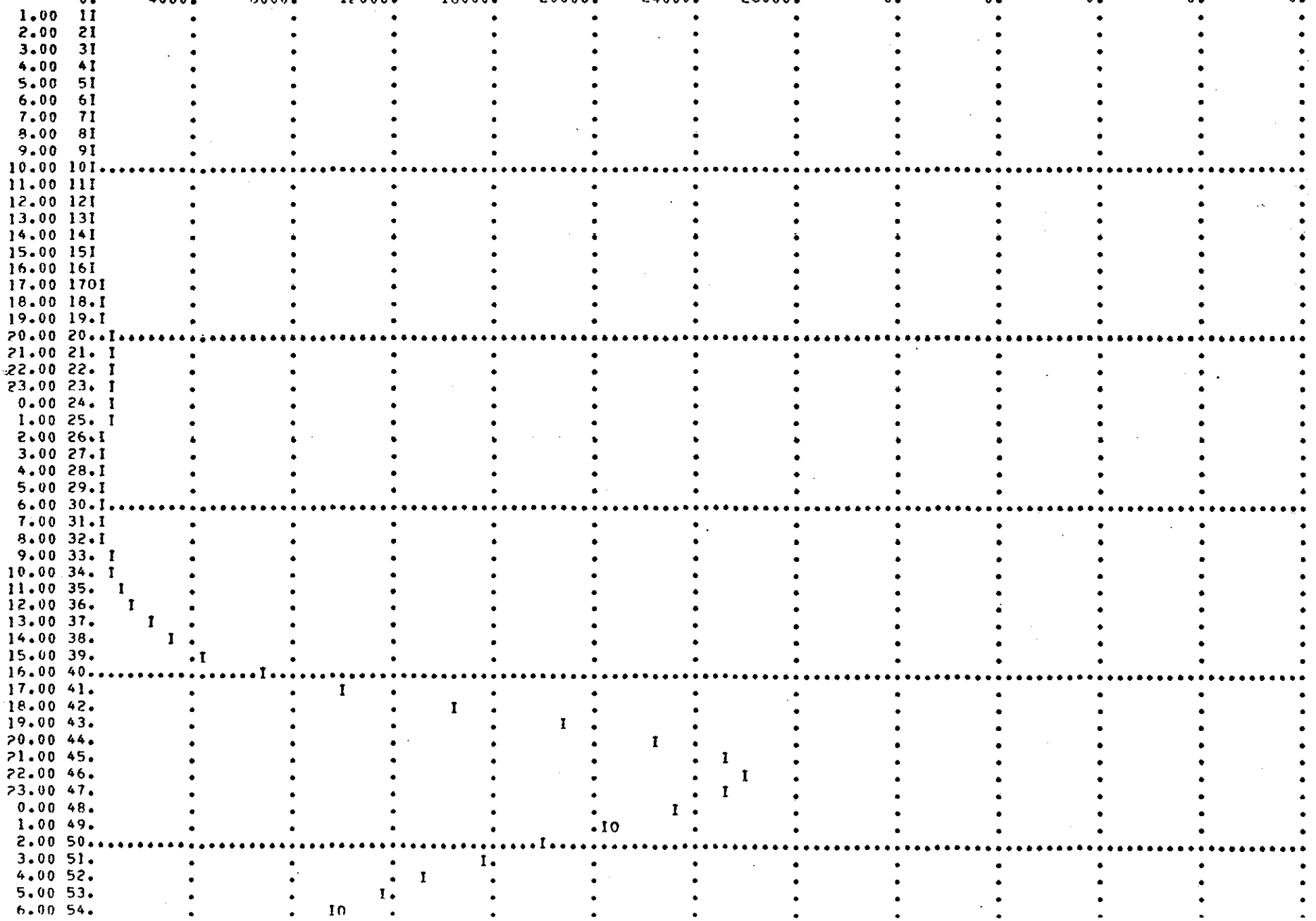
PEAK OUTFLOW IS 26013. AT TIME 46.00 HOURS

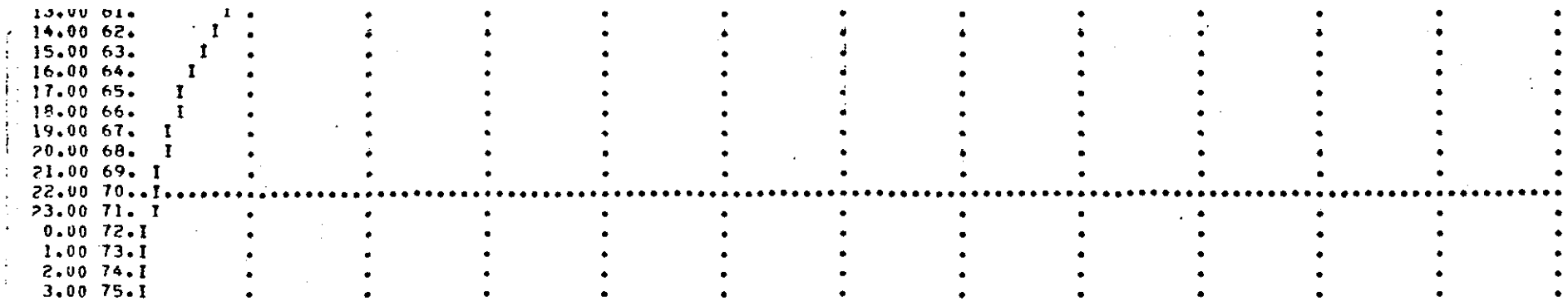
	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	26013.	23637.	12764.	4706.	338844.
CMS	737.	669.	361.	133.	9595.
INCHES		8.66	18.70	20.68	20.68
MM		219.88	474.92	525.34	525.34
AC-FT		11721.	25316.	28003.	28004.
THOUS CU M		14458.	31227.	34542.	34542.

OVF

STATION 1

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)




13.00 61. I
14.00 62. I
15.00 63. I
16.00 64. I
17.00 65. I
18.00 66. I
19.00 67. I
20.00 68. I
21.00 69. I
22.00 70..I
23.00 71. I
0.00 72.I
1.00 73.I
2.00 74.I
3.00 75.I

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50	RATIO 2 1.00
HYDROGRAPH AT	1	25.40	1	13009.	26018.
	(	65.79)	(	368.38)(	736.76)(
ROUTED TO	1	25.40	1	13003.	26013.
	(	65.79)	(	368.19)(	736.62)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	100.00	104.70
STORAGE	0.	0.	13.
OUTFLOW	0.	0.	1348.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	112.05	7.35	36.	13003.	25.00	46.00	0.00
1.00	117.20	12.50	59.	26013.	31.00	46.00	0.00

A. Size Classification

Height of dam = 37 ft.; hence small

Storage capacity at top of dam (elev. 100.0±) = 49 AC-FT.; hence small

Adopted size classification small

B.i) Hazard Potential

This dam is located upstream of and urbanized area. Residential homes are located along the downstream channel. The dam was originally used for process water and fire protection by American Felt Co. Presently, it has no specific function.

ii) Impact of Failure of Dam at Maximum Pool (Top of Dam)

It is estimated from the rule of "thumb" failure hydrograph, that the following adverse impacts are a possibility by the failure of this dam.

a) Loss of homes Yes 5-8 ;
b) Loss of buildings Yes (Commercial) ;
c) Loss of highways or roads No ;
d) Loss of bridges No ;

The failure profile can affect a distance of 3000 feet from the dam.

C. Hazard Potential Classifications

HAZARD	SIZE	TEST FLOOD RANGE
High	Small	1/2 PMF to PMF

Adopted Test Flood = 1/2 PMF = 510 CSM

= 13,000 CFS

D. Overtopping Potential

Drainage Area 16,267 Acres = 25.4 sq. miles

Spillway crest elevation = 100.0 NGVD

Top of Dam Elevation = 104.7 NGVD

Maximum spillway discharge

Capacity without overtopping of dam = 1,335 CFS
"test flood" inflow discharge = 13,000 CFS
"test flood" outflow discharge = 13,000 CFS

AMERICAN FELT DAM

Dam Failure Analysis

1. Failure discharge with pool at top of dam (elev. 104.7) = 9479 CFS
2. Depth of water in reservoir at time of failure = 35 ft.
3. Maximum depth of flow downstream of dam = @ Face 15.5 ft.
4. Water surface elevation just downstream of dam at time of failure) = 80.5 NGVD

The failure discharge of 9479 CFS will enter and flow downstream 3000 feet until the brook reaches Pemberwick Dam. Valley storage in this 3000 foot length of brook is substantial in reducing the discharge. Also due to roughness characteristics, obstructions and frictional losses, it is very likely that the unsteady dam failure flow will dissipate its wave and kinetic energy and thus convert to steady and uniform flow obeying Manning's formulae 3000 feet downstream. The failure profile will have the following hydraulic characteristics:

DISTANCE FROM THE DAM	WATER SURFACE ELEVATION NGVD	REMARKS
0	104.7	Upstream of dam
0	80.5	Downstream of dam
1000	61.5	
2000	56.5	
3000	51.2	

Beyond 3000 feet, Pemberwick Dam controlls the failure discharge:

Q = N/A CFS; S = N/A

n = N/A ; b = N/A ; d = N/A

"Rule of Thumb Guidance for Estimating Downstream Dam Failure Analysis"

DATA

Name of Dam American Felt Dam

Location North of Pemberwick, CT

Drainage Area 25.4 sq. mi., Top of Dam 104.7 NGVD

Spillway Type Overflow-broad crest, Crest of Spillway 100.0 NGVD

Surface Area @ Crest Elev. 2.6 Acres = 0.004 sq. mi.

Pool Bottom Near Dam = 67.7± NGVD

Assumed Side Slopes of Embankments = 2:1

Depth of Pool at Dam (Yo) = 37 Feet

Mid-Height Elev. 86.2 NGVD

Length of Dam at Crest = 187.8 Feet

Length of Dam at Mid-Height = 109 Feet

25 % of Dam Length at Mid-Height = W_b = 27 Feet

Step 1

Storage (S) at time of failure 49 Ac-FT
(Equal to top of dam)

Step 2

Peak Failure Discharge

$Q_{pl} = 8/27\ W_b\ \sqrt{g}\ Yo^{3/2}$

$= 1.68\ W_b\ Yo^{3/2} =$ 9479 cfs

Failure is assumed to coincide with pool elevation at top of dam.

Pemberwick Dam is located 3000 feet downstream of American Felt dam. There is a 20 foot drop to Pemberwick Dam which will cause the dissipation of wave and kinetic energy of the failure discharge. Approximately, the water surface elevations between American Felt dam and Pemberwick Dam will be as given on Dam Failure Analysis. The increase of depth at Pemberwick Dam due to failure of American Felt dam is estimated to be 6.2 feet.

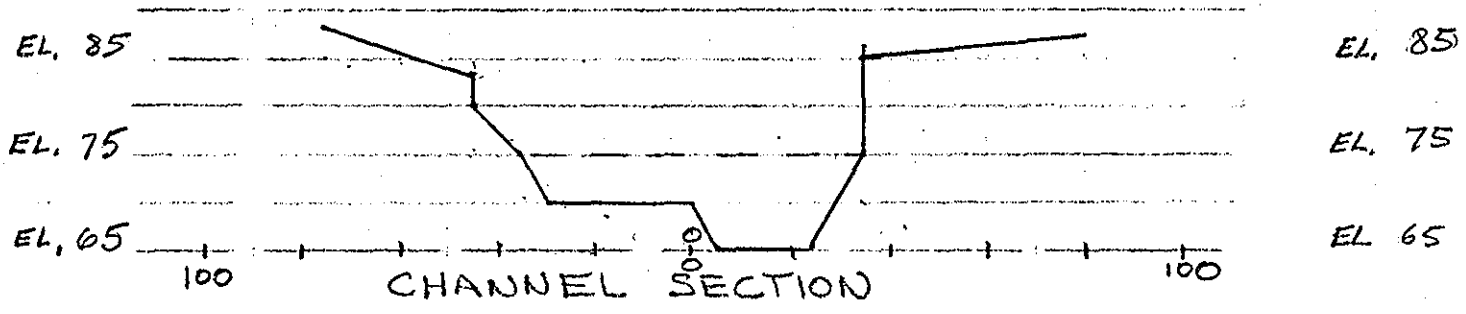
DOWNSTREAM W.S.EL. COMPUTATIONS

NAME OF DAM: AMERICAN FELT DAM

SECTION LOCATION: AT FACE DOWNSTREAM OF DAM

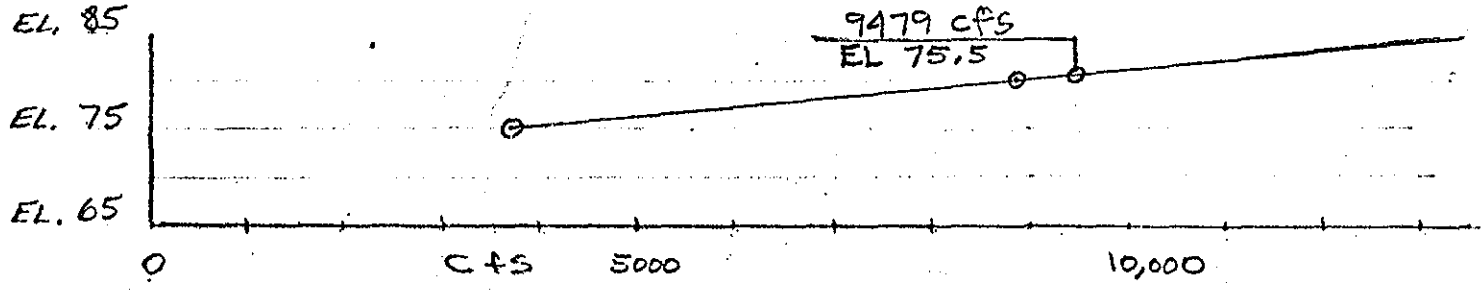
USING: $Q = 1.486/n \, A \, R^{2/3} \, S^{1/2}$

WHERE: n = 0.05 S = SLOPE = 0.006'/'



Q_P = 9479 STORAGE (S) 42

ELEV.	AREA	WP	R	$R^{2/3}$	$S^{1/2}$	1.486/n	Q	DEPTH
75	450	70	6.43	3.46	.08	29.72	3702	10
80	825	86	9.59	4.52	.08	29.72	8866	15
85	1235	105	11.76	5.17	.08	29.72	15,188	20



DEPTH @ DOWNSTREAM FACE OF DAM
EQUAL TO 15.5 OR EL 80.5

STAGE DISCHARGE = 9479 ELEV = 80.5 OR A D = 15.5

NEXT DOWNSTREAM SECTION 1000 ft.

PURCELL ASSOCIATES

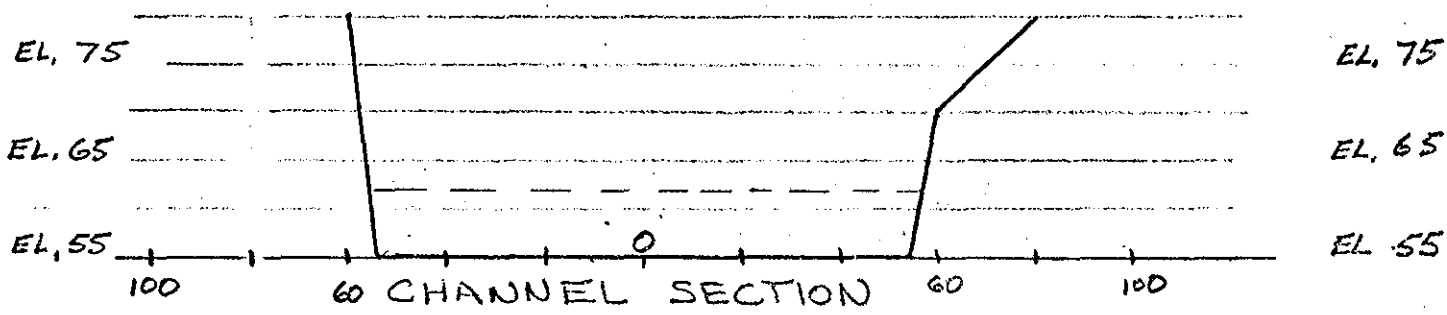
DOWNSTREAM W.S.EL. COMPUTATIONS

NAME OF DAM: AMERICAN FELT DAM

SECTION LOCATION: 1000' DOWNSTREAM OF DAM

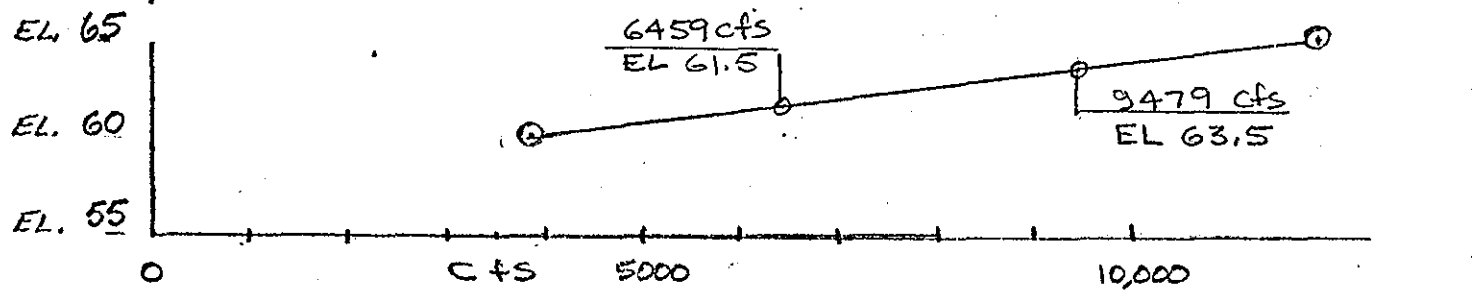
USING: $Q = 1.486/n \, A \, R^{2/3} \, S^{1/2}$

WHERE: n = 0.05 S = SLOPE = 0.006 1/1



Q_{P_1} = 9479 cfs STORAGE (S) 42

ELEV.	AREA	WP	R	$R^{2/3}$	$S^{1/2}$	1.486/n	Q	DEPTH
60	555	110	5.05	2.94	.08	29.72	3882	5
65	1125	120	9.38	4.45	.08	29.72	11,893	10
					.08	29.72		



$V_1 = \frac{15.5+8.5}{2} \times \left(\frac{80+114}{2} \times 1000 \div 43560\right) 1/2 = 13.4$ Ac-ft (2.23)

$Q_{P_2(TRIAL)} = Q_{P_1}(1 - V/S) = 6459$ cfs

$V_2 = \frac{15.5+65}{2} \times 2.23 \times 1/2 = 12.3$ Ac.ft. $V_{AVE} = 12.9$

$Q_{P_2} = Q_{P_1}(1 - V_{AVE}/S) = 6579$ cfs

STAGE DISCHARGE = 65.79 ELEV = 61.5 OR A D = 6.5

NEXT DOWNSTREAM SECTION 1000 ft.

PURCELL ASSOCIATES

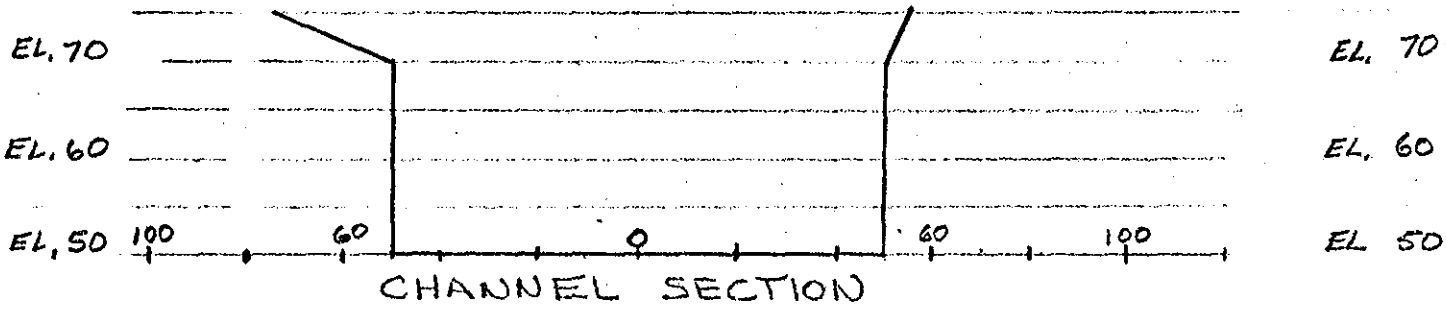
DOWNSTREAM W.S.EL. COMPUTATIONS

NAME OF DAM: AMERICAN FELT DAM

SECTION LOCATION: 2000' DOWNSTREAM OF DAM

USING: $Q = 1.486/n \, A \, R^{2/3} \, S^{1/2}$

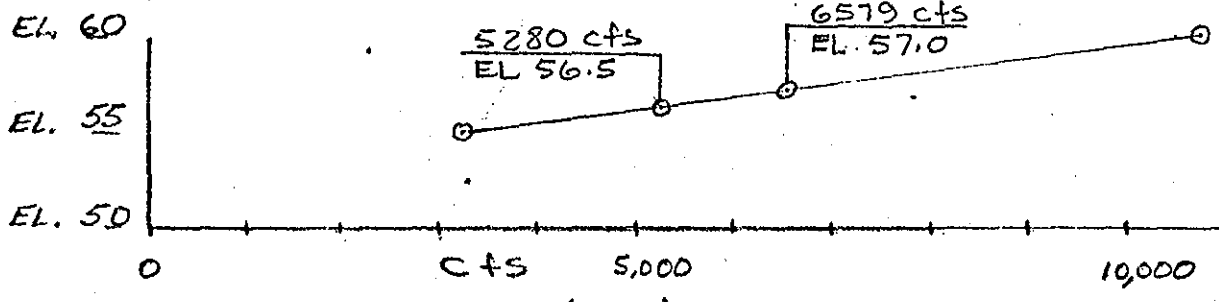
WHERE: n = 0.05 S = SLOPE = 0.006 1/1



CHANNEL SECTION

Q_{P_1} = 6579 STORAGE (S) 42

ELEV.	AREA	WP	R	$R^{2/3}$	$S^{1/2}$	1.486/n	Q	DEPTH
55	500	110	4.55	2.74	.08	29.72	3262	5
60	1000	120	8.33	4.11	.08	29.72	9773	10
						29.72		



$V_1 = \frac{6.5+7.0}{2} \times \left(\frac{114+100}{2} \times 1000 \div 43{,}560\right)^{1/2} = 8.3$ Ac-ft (2.46)

Q_{P_2} (TRAIL) = $Q_{P_1}(1 - V/S)$ = 5280 cfs

V_2 = 6.5 x 2.46 x 1/2 = 8.0 Ac-ft V_{AVE} = 8.15 Ac-ft

$Q_{P_2} = Q_{P_1}(1 - V_{AVE}/S)$ = 5302 cfs

STAGE DISCHARGE = 5302 ELEV = 56.5 OR A D = 6.5

NEXT DOWNSTREAM SECTION 1000 ft.

PURCELL ASSOCIATES

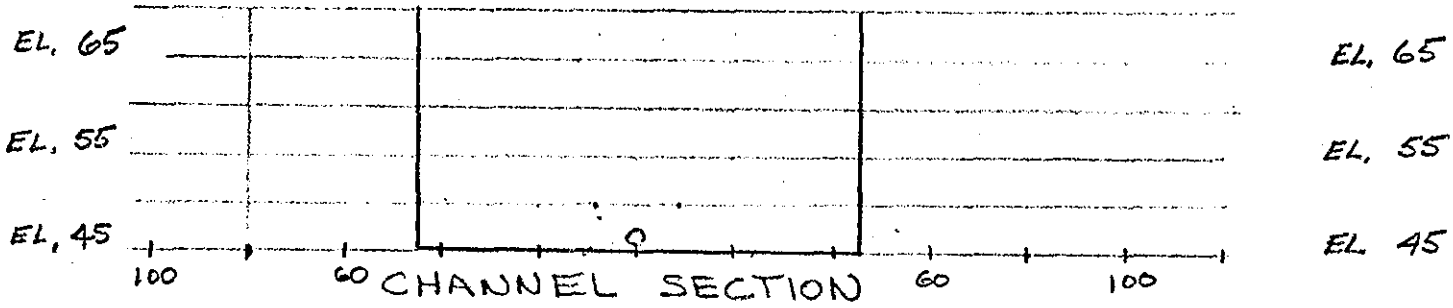
DOWNSTREAM W.S.EL. COMPUTATIONS

NAME OF DAM: AMERICAN FELT DAM

SECTION LOCATION: 3000' DOWNSTREAM OF DAM

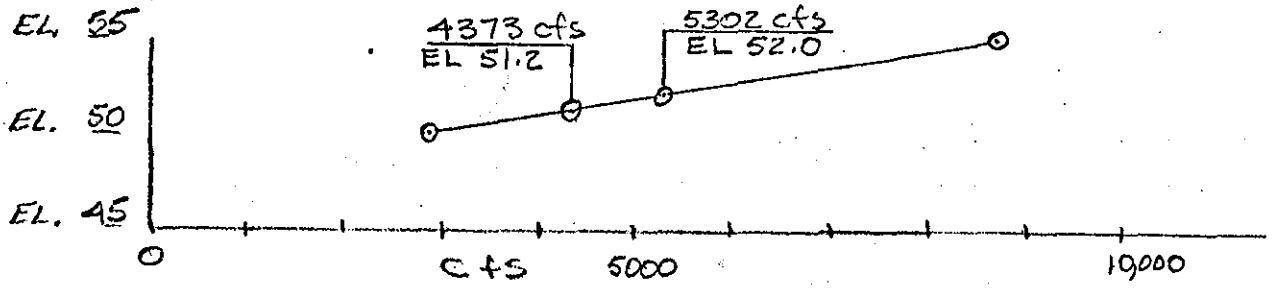
USING: $Q = 1.486/n \, A \, R^{2/3} \, S^{1/2}$

WHERE: n = 0.05 S = SLOPE = 0.006 ft/ft



Q_{P_1} = 5302 STORAGE (S) 42

ELEV.	AREA	WP	R	$R^{2/3}$	$S^{1/2}$	1.486/n	Q	DEPTH
5	450	100	4.5	2.73	.08	29.72	2916	5
10	900	110	8.18	4.06	.08	29.72	8689	10
						29.72		



$V_1 = \frac{6.5+7.0}{2} \times \left(\frac{100+90}{2} \times 1000 \div 43560 \right) \times 2.18 \times 1/2 = 7.4$ Ac-ft

Q_{P2} (TRIAL) = $Q_{P1}(1 - V/S)$ = 4373 cfs

$V_2 = \frac{6.5+6.2}{2} \times 2.18 \times 1/2 = 6.9$ Ac-ft. V AVE = 7.2 Ac-ft.

$Q_{P2} = Q_{P1}\left(1 - \frac{V_{AVE}}{S}\right)$ = 4393 cfs (SEE PEMBERWICK COMP'S FOR CONTINUATION)

STAGE DISCHARGE = 4393 ELEV = 51.2 OR A D = 6.2

NEXT DOWNSTREAM SECTION N/A ft.

PURCELL ASSOCIATES

RATING CURVE DEVELOPMENT

American Felt Dam

Spillway

$$Q = C\ L\ H^{2/3}$$

$C = 2.70$

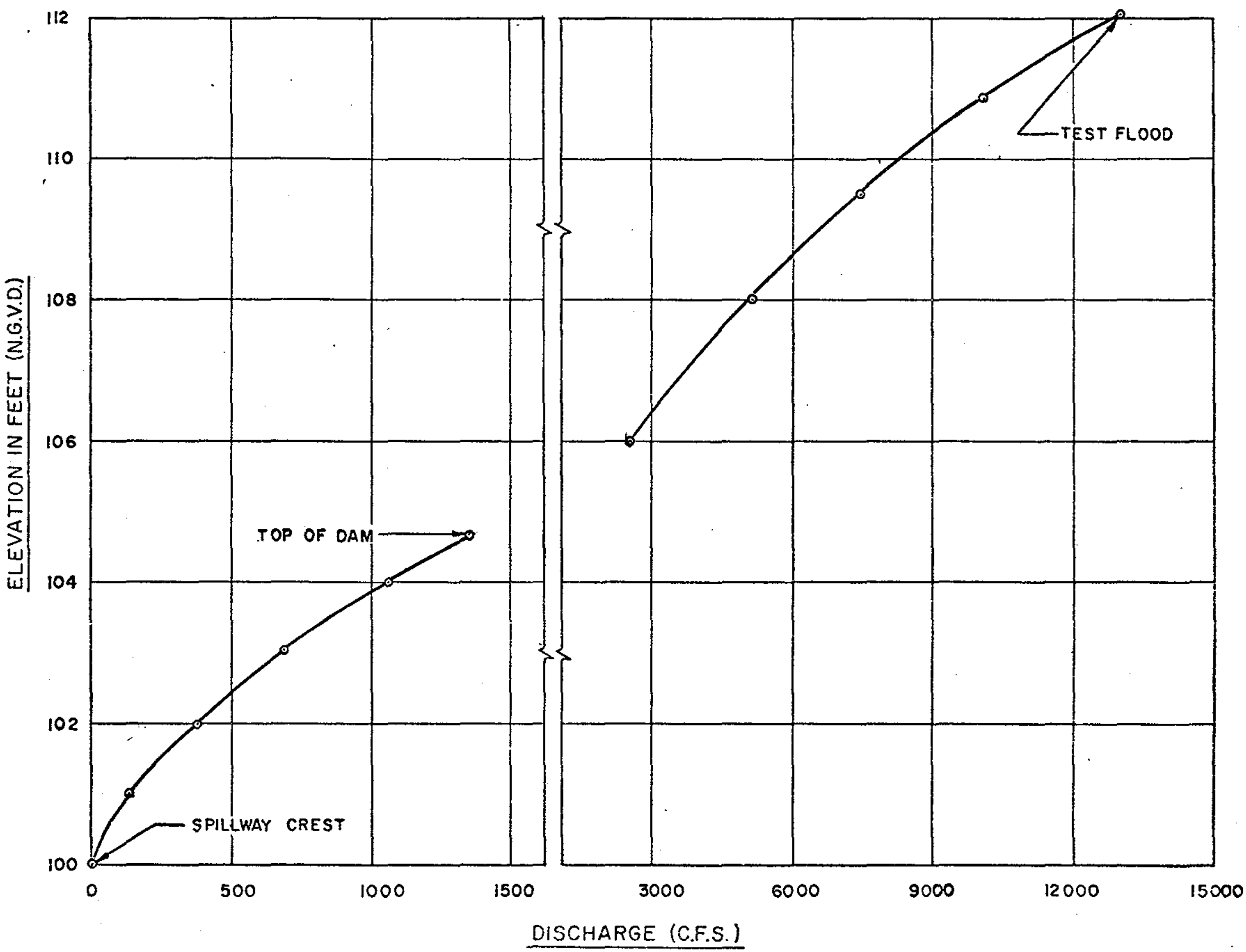
$L = 49$ feet

12 Inch Pipe

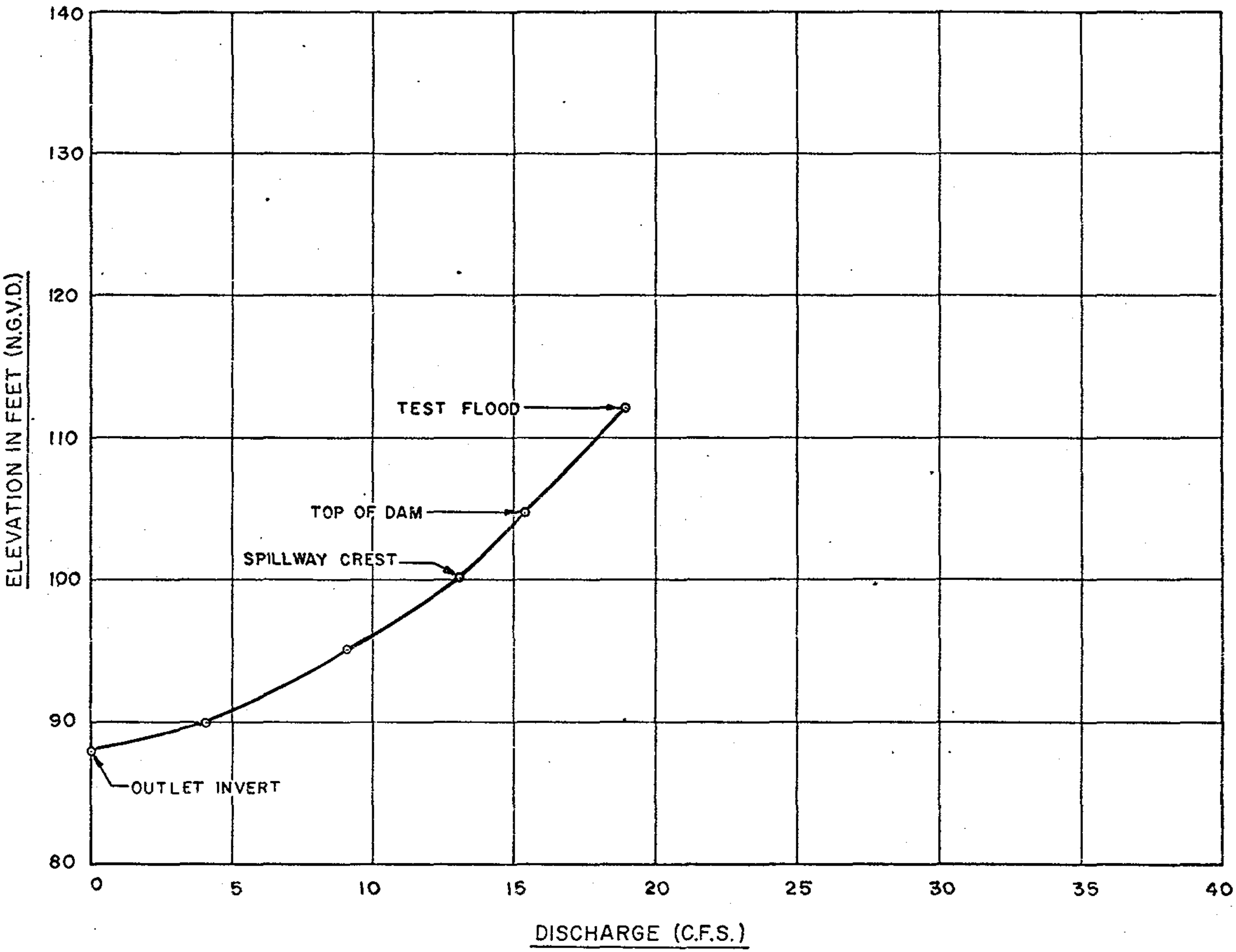
$$Q = c\ a\ (2gh)^{1/2}$$

$c = .60$

$a = .79$ square feet

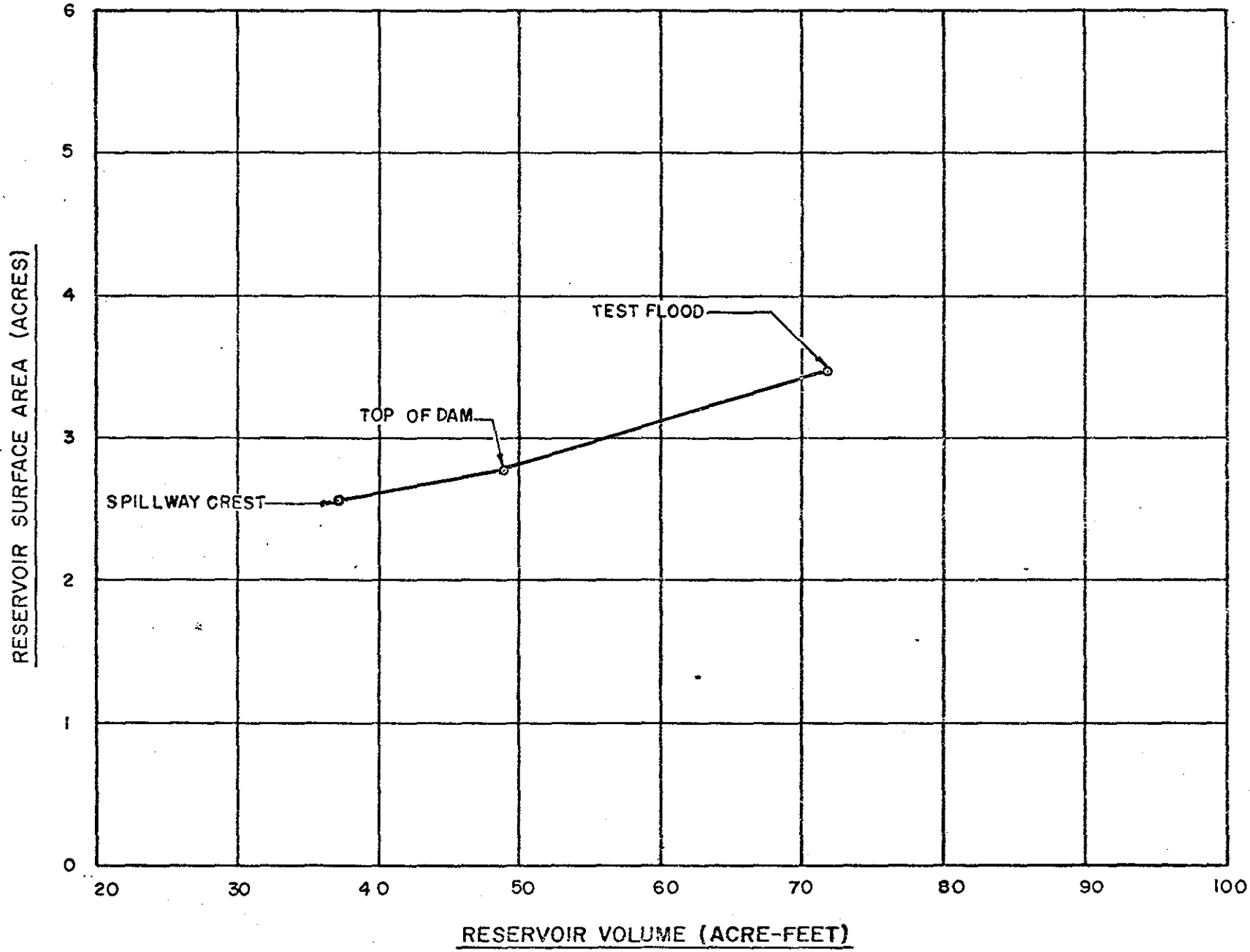


AMERICAN FELT DAM
SPILLWAY RATING CURVE



AMERICAN FELT DAM
12 INCH PIPE
OUTLET WORKS RATING CURVE

D-28



AMERICAN FELT DAM

D-29 RESERVOIR AREA-CAPACITY CURVE

APPENDIX E

INFORMATION AS CONTAINED IN THE

NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(10) NAME	(11) LATITUDE (NORTH)	(12) LONGITUDE (WEST)	(13) REPORT DATE DAY	MO	YR
CT	03	NED	CT	001	04				AMERICAN FELT DAM	4102.3	7340.0	21	DEC	79

(14) POPULAR NAME	(15) NAME OF IMPOUNDMENT
	MILL POND

(16) REGION	(17) BASIN	(18) RIVER OR STREAM	(19) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(20) DIST FROM DAM (MI.)	(21) POPULATION
01	07	BYRAM RIVER	PEMBERWICK	1	1000

(22) TYPE OF DAM	(23) YEAR COMPLETED	(24) PURPOSES	(25) STRUCTURAL HEIGHT (FT.)	(26) HYDRAULIC HEIGHT (FT.)	(27) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	NORMAL (ACRE–FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
PGVAOT	1867	0	37	37	49	36	NED	N	N	N	N	

(28) REMARKS
22 AESTHETIC 21=CEMENT RUBBLE MASONRY

(29) D/S HAS	(30) SPILLWAY CREST LENGTH	(31) TYPE	(32) WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) PROPOSED (MW)	(37) NAVIGATION LOCKS NO.	(38) LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
1	208	U	49	1335	3600											

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
FAIRFIELD ASSOCIATES INC		

(49) REGULATORY AGENCY DESIGN	CONSTRUCTION	(50) OPERATION	(51) MAINTENANCE
		CT DEPT ENVIR PROT	CT DEPT ENVIR PROT

(52) INSPECTION BY	(53) INSPECTION DATE DAY	MO	YR	(54) AUTHORITY FOR INSPECTION
JAMES P PURCELL ASSOCIATES INC	12	NOV	79	PL=92=367

(55) REMARKS